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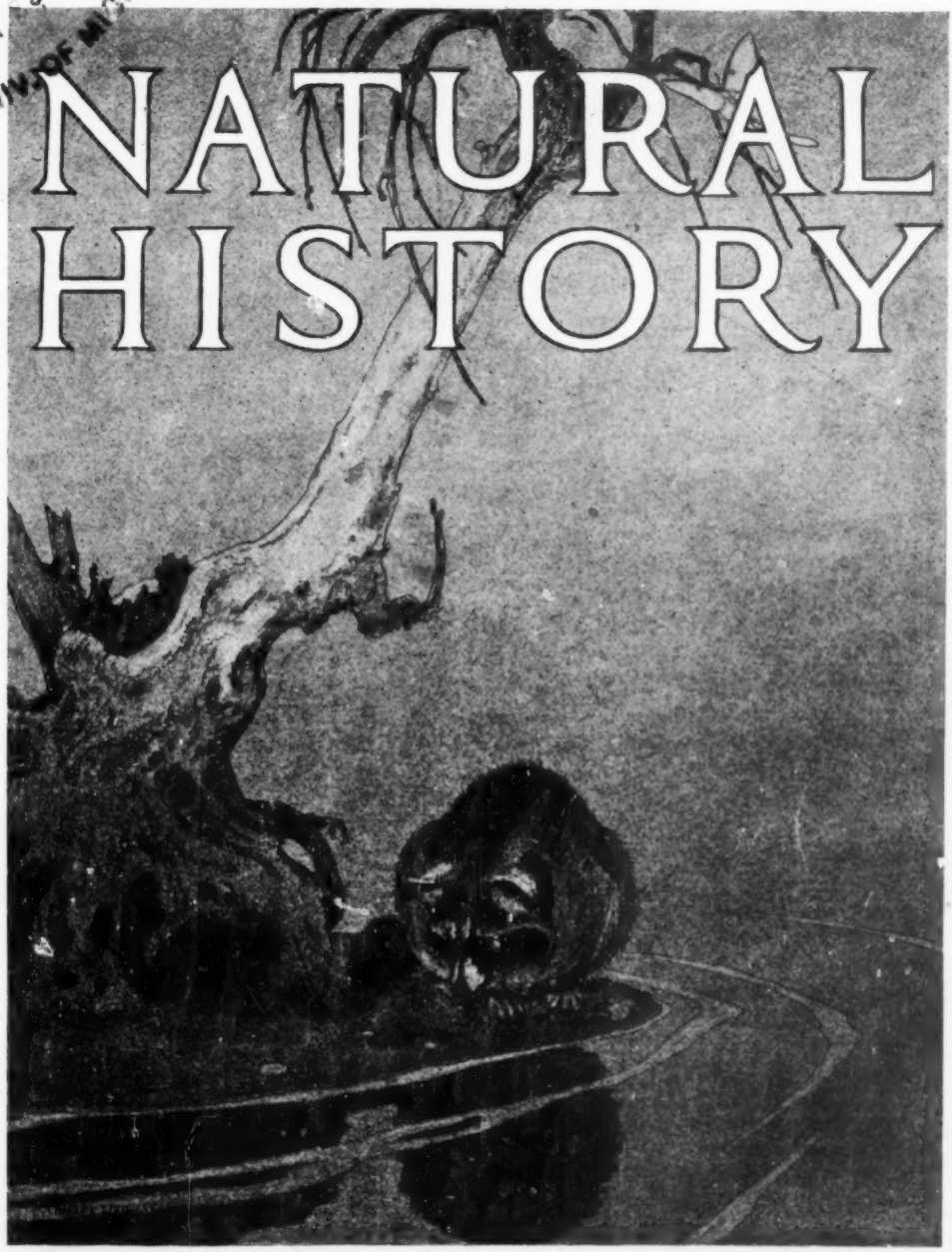

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DR. V. K. TING
Director of the National Geological Survey of China

NATURAL HISTORY
VOLUME XXI JANUARY-FEBRUARY, 1921 NUMBER 1

THE NATIONAL GEOLOGICAL SURVEY OF CHINA

BY

J. G. ANDERSSON*

The geology of China is so closely related to the future welfare of that country, and especially to its agriculture, its forestry, its mines, and mechanical industries, that we welcome in NATURAL HISTORY the full and interesting account of the National Geological Survey and its fine museum, prepared by Dr. J. G. Andersson, well known as a geologist and palæontologist, who was called from the University of Upsala to the staff formed by Director V. K. Ting; and as the Survey of New York State was the most important factor in building up the state museum, so we may be sure that the Survey of China will give a great impetus to the establishment of museums in that country. When our thoughts go back to the institution of the Natural History Survey of the State of New York in 1836 and we witness the intellectual and practical benefits to the people of the state, we may express the hope and belief that the year 1911 may be no less auspicious in the future history of China.

In its Third Asiatic Expedition the American Museum of Natural History plans to coöperate with the Geological Survey of China in the same way that it at home is coöperating with our national and state surveys for the promotion of knowledge and the welfare of the people.

—HENRY FAIRFIELD OSBORN.

THE young and progressive institution which carries the name "The Geological Survey of China" is a child of the revolution which overthrew the Imperial régime of the Manchus and inaugurated the present Republican era. When, at the end of 1911, the Provisional Government was formed at Nanking, Mr. H. T. Chang, a graduate of Tokyo University, was appointed chief of the section of geology in the Department of Mines under the Board of Commerce and Industries, and in the following year he published in the *Proceedings of the Geographical Society of China* a program for a systematic geological survey of the country.

Upon the removal of the Central Government to Peking, Mr. Chang was appointed geological expert in the Ministry of Agriculture and Forestry. Shortly afterward the two ministries became amalgamated as the Ministry of Agriculture and Commerce, and the section of geology of the Bureau of Mines came under the leadership of Dr. V. K. Ting, a pupil of the eminent British geologist, Professor J. W. Gregory, of Glasgow.

When it was planned by Messrs. Chang and Ting to begin extensive geological field researches, a serious difficulty was encountered in the total lack of a staff of experienced field geologists. In his above mentioned program for a national geological institute Mr. Chang had proposed the establishment of a school for the training of surveying geologists, and this school was organized in September, 1913, with Mr. Chang as its director.

The pupils were selected from among the graduates of middle schools, and the aim of the enterprise was to give to these young men a course of about three years' intensive training in the branches necessary to a field geologist. It will be noted that this "geological school" boldly replaced university training as it was then given, and the eminent success of the experiment will commend it to the interest of all colleagues of Messrs. Chang and Ting, who in other countries have tried to solve by different methods the

*Late Director of the Geological Survey of Sweden, Mining Adviser to the Chinese Government, and Curator of the Museum of the Geological Survey of China

Students of the Geological School, Peking, during an excursion in the Kaiping coal basin, April, 1916

difficult problem of recruiting a body of field geologists.

The teachers of the Geological School were mostly officials in the Ministry of Agriculture and Commerce who, during nearly three years, persistently carried on these courses voluntarily and without any remuneration. Within an officialdom which by foreign writers is not infrequently spoken of with contempt as being devoid of patriotic sentiments, this patient and unostentatious work certainly stands out as a piece of splendid patriotism. I believe that it has never before been told in foreign language how these representatives of Young China quietly but zealously worked for years to teach a still younger generation how to open up this immense country for geological research. It gives me especial pleasure to pay this tribute to the teachers of the Geological School, which is no longer in existence because it has fully accomplished its aim, which was to give the Geological Survey of China its first staff of efficient field men.

I well recall these courses which, during the later terms, were held in the premises of the present Geological Survey where I also had my office. At every hour of the day the bell rang for a change of teachers, and often, when I arrived to begin my day's work, I met one or another of my Chinese friends who had just finished his first teaching hour for the day and who then went to his routine work in some office of the Ministry.

Besides Mr. Chang, the founder of the school, and Dr. Ting, the director of the present Geological Survey, I want to mention among the teachers Dr. W. H. Wong, graduate of the University of Louvain, a charming man and distinguished scientist, our petrologist who, in Dr. Ting's absence, is acting director of the Geological Survey.

Another most noteworthy member of the staff of teachers of the Geological School was Mr. Chang Yi-ou, M. E., educated in Mons. He was the first director of the Department of Mines, a position so eminent that a holder of such a rank in title-ridden Europe would hardly dream of stepping down to become a teacher of youths. Yet, in this land of ceremonies and of formalism, this high mandarin, in rank next to a Minister of State, walked quietly to his classes in metallurgy.

The subjects of study in the school were selected for the sole purpose of

training geologists for the Survey. Besides pure and applied geology, including mineralogy, petrology, and palæontology, with some short courses in biological sciences, the program included chemistry, physics, geodetic and topographic surveying, mining methods, the elements of metallurgy, and some teaching of foreign languages.

The training was conducted not only in the schoolroom but also during numerous and trying field excursions. The average upper class Chinese is very little inclined to corporal exertions, but the writer of this article, who has traveled with educated Chinese of many types, can testify that the graduates of the Geological School have totally abandoned the sedan chair and fully realize that a pair of strong legs is the field geologist's sovereign means of locomotion.

When the last term of the school neared its end I was asked by the Minister of Agriculture and Commerce to undertake the examination of the twenty-two students, and I was permitted to conduct this in the form of an excursion in the Kaiping coal basin, where we stayed ten days. During the first three days we went as one party all over the field, after which each student was given a week's time to examine a selected portion of the region in detail. To some was assigned a mine, to others a special group of strata, and to still others an examination of the industries based upon the mineral materials of the region.

After their reports, written in English, had been turned in, I had the pleasure, in consultation with the director and the teachers of the school, to recommend the larger number of the graduates for promotion to junior membership on the staff of the Geological Survey.

There is no doubt that the Geological School has proved a success. I have since carried on field work for months with a number of these young men. There are of course large individual differences, but these men are all serious and very active workers. A number of them have been sent abroad, mostly to the United States, for additional training. One of them, who recently left for the United States, completed, before his departure, a monograph in English on the western hills of Peking, which is a piece of remarkably ripe and clear thinking, while at the same time it is a fine linguistic performance for a young fellow who had never been abroad. The paper is now in print and will soon be distributed.

This article began with the statement that the Geological Survey was in its beginning a product of the revolution of 1911. In its present form it is a creation of the Emperor-elect Yuan-Shih-Kai, who in 1916 was the center of an attempt to restore the monarchy.

In 1915 the writer of this article had an opportunity, under the auspices of the then Minister of Agriculture and Commerce, Chow-Tzu-Chi, to explain during a two hours' audience to President Yuan, and to illustrate by means of maps, sections, and numerous specimens, the result of our work with reference to iron ore deposits. This demonstration remains for me a most remarkable memory because of the deep impression I received of the powerful strength and penetrating genius of this man who was then the almighty ruler of China. I believe that to some small extent it contributed toward giving to President Yuan a clearer understanding of the methods and possibilities of geological research.

The would-be emperor, Yuan, desired to enhance the splendor of his ascension to the throne by creating a number of modern institutions intended to promote industries and education. Orders to this effect were given to the different ministers, and in our Board a number of institutions were planned or created, among them an enlarged Geological Survey with a considerable staff and a budget able to meet the necessary

CENTRAL BUILDING OF THE GEOLOGICAL MUSEUM, PEKING

EXHIBITION IN THE GEOLOGICAL MUSEUM, PEKING, DEVOTED TO IRON AND COAL

THE SECTION OF STRATIGRAPHY AND PALÆONTOLOGY

METALLIFEROUS DEPOSITS (EXCEPT IRON)

expenses. Some of Yuan's innovations have not materialized because of the prolonged political struggle which followed upon his tragic downfall. But the Geological Survey has, under Dr. Ting's able and determined leadership, always enjoyed the full support of the men in power, and has become such an important factor in the development of China's mineral resources that it may be safe to consider its continued growth fully assured.

NONMETALLIC DEPOSITS (EXCEPT COAL)

The staff of the Survey at present includes thirty persons, among them eighteen field geologists. For practical reasons the Ministry has very largely utilized the personnel for the examination of various kinds of mineral deposits, and a large number of ore bodies and coal fields have been surveyed in detail on the scales of 1: 20,000, 1: 10,000, and larger scales. The iron ore deposits have been made the object of special detailed research, and a monograph on the iron ore resources of China, prepared by Dr. F. R. Tegengren, who for a number of years was connected with the Survey, is ready for publication.

The general geological survey of the provinces of Chihli, Shantung, and Shansi has also made considerable progress, and the geological description of the two last named provinces will soon be completed. Surveys for China's participation in the international geological map on the scale of 1: 1,000,000 have recently been begun.

Two series of publications have begun to appear, a *Bulletin* for smaller communications and *Memoirs* for larger monographic work. The first number of the *Bulletin* (1919) is available to the public, as well as the first *Memoir*, in which Dr. Wong gives a summary of all available data on the mineral resources of China (metals and nonmetals except coal). In this work is contained a vast amount of information on the mineral deposits of China hitherto absolutely unattainable to foreigners. So far Dr. Wong's work is issued only in Chinese,

but a French edition is planned to appear in the near future.

No distribution of the publications to geological surveys in other countries will take place before another far advanced memoir is fully completed.

The greatest difficulty for scientific work within the Survey has been the lack of literature. In the early part of this year the director of the Survey succeeded in collecting from private donors, principally a number of mining companies, funds sufficient to start the establishment of an up-to-date geological library. The building is under construction, and at the same time the literature is being collected through many channels in Europe, as well as in the United States of America.

Even in the early days of the Survey a beginning was made in the establishment of a geological and palæontological museum. The larger part of the exhibition is devoted to the mineral resources of the country. In addition to a large section devoted to practical geology there are small but comprehensive collections of the minerals of China and of its igneous rocks and its fossils. The stratigraphic section is at present undergoing revision, and a section for dynamic geology has recently been organized. At present there are 2850 specimens on exhibition, under glass and properly labeled, all collected in China by our own men.

A very considerable extension of the museum is contemplated within a few years, in order to put on exhibition the large series of animal and plant fossils which we have already collected and which are at present in the hands of a number of specialists for monographic preparation.

It is not surprising that a Geological Survey which is only a few years old and which has been kept busy with technical problems, has not yet had time to do much purely scientific research. But extensive and systematic collecting of fossils of all kinds has been carried on during a number of years, and several prominent coworkers have been secured for the examination of this material.

In 1917 Dr. Th. G. Halle, keeper of the palæobotanical department of the Stockholm Museum of Natural History, traveled extensively in this country, collecting fossil plants. Since then we have continued the collecting, and at present Dr. Halle is engaged in the study of the very extensive material of Palæozoic and Mesozoic floras thus brought together.

In 1916 I began research work on the Cenozoic deposits of northern China, and in this connection a large number of fossil vertebrates, mostly mammals, have been brought together. As palæontological collaborator for this material I have succeeded in securing the coöperation of another of my countrymen, Prof. Carl Wiman, of Upsala, who is now engaged in preparing a monograph on the Hipparion fauna.

Recently Dr. A. W. Grabau, formerly professor of palæontology in Columbia University, New York, has come to China in the joint capacity of palæontologist to the Geological Survey and professor of palæontology in the National University of Peking. This eminent expert on invertebrate fossils has begun work on the material, mostly of Palæozoic age, which has been accumulated as the result of a number of seasons of field work.

It has been decided by the director of the Survey to issue the monographs to be prepared by Messrs. Grabau, Halle, and Wiman, as well as by other future palæontological coworkers, in a special publication entitled *Palæontologia Sinica*, which is intended to cover in a series of independent monographs all the fossil faunas and floras of China proper, as well as such material from the vast dependencies of China as may be brought together by the Survey.

JET AND TURQUOIS INLAY

These objects were found in the ruin of Pueblo Bonito by members of the Hyde Expedition

DATING OUR PREHISTORIC RUINS

THE SEARCH FOR CIVILIZATION'S TIME CLOCK IN THE SOUTHWEST MAY REVEAL DEFINITE FACTS REGARDING THE STORY OF MAN IN PREHISTORIC AMERICA

BY

CLARK WISSLER

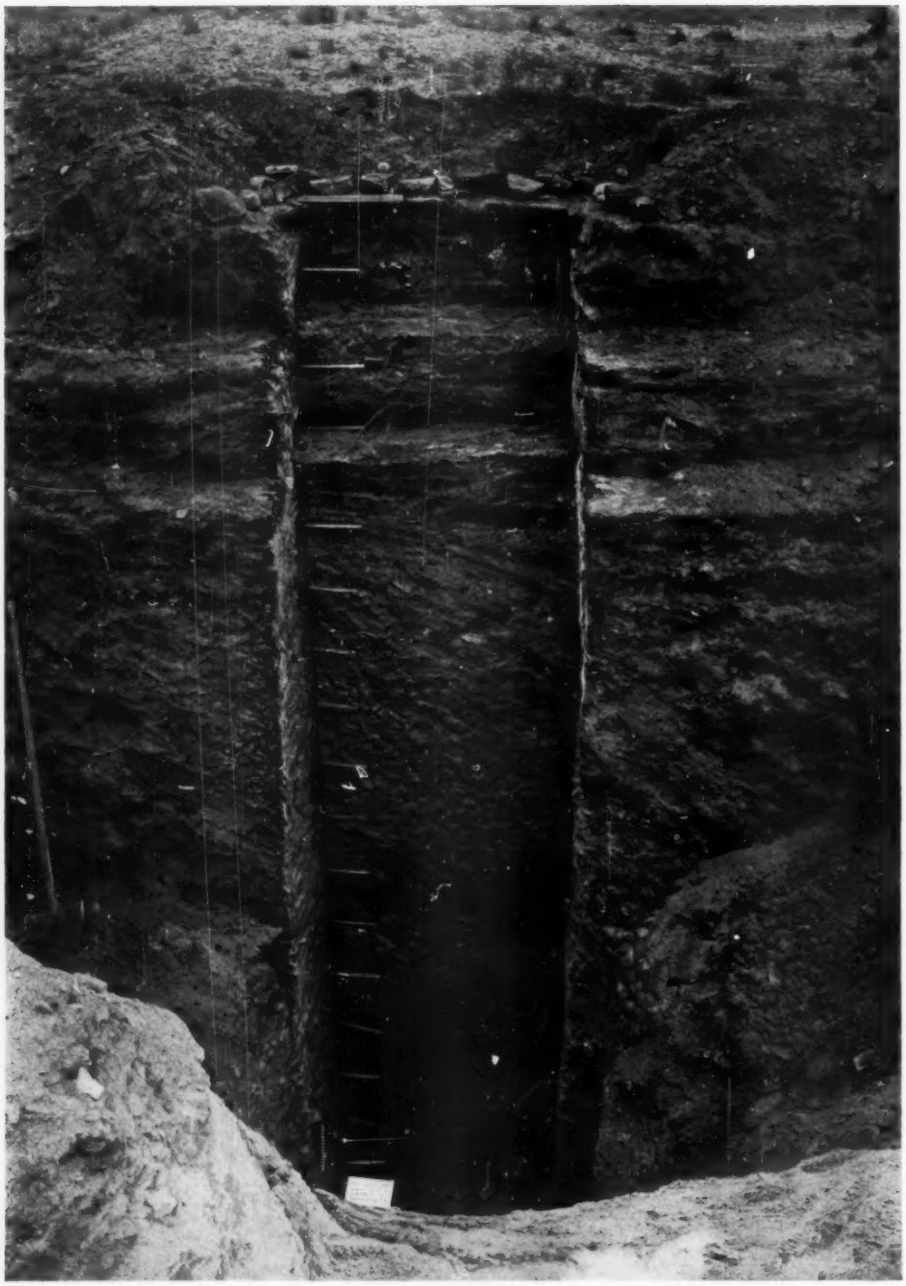
FOREWORD.—The Archer M. Huntington Survey of the Southwest was organized in 1909 by Clark Wissler, curator of anthropology in the American Museum, to include work among the living Indians of the American Southwest as well as a search for the history of the builders of the ruins so numerous throughout that region. The persons who have taken an active part in the investigations are: P. E. Goddard, R. H. Lowie, H. J. Spinden, N. C. Nelson, Leslie Spier, E. H. Morris, and M. L. Kissell, of the American Museum staff. In addition, a special investigation of the Zuñi was made by Prof. A. L. Kroeber, of the University of California. The tree-ring investigation has been delegated to Prof. A. E. Douglass, of the University of Arizona, the originator of the method. The entire investigation to date has been supported by Mr. Archer M. Huntington.

FOR many years a band of wild Indians concealed themselves in a bit of wilderness in the mountains of California, but were at last reduced to a single man, who, after a hopeless struggle against hunger and want, staggered forth into civilization and into captivity. Through the humanity of two or three professors in the University of California, he was given a home. He became the subject of many investigations. One of these professors, an expert in archery, soon found that, although the Indian had always used the bow, his archery was inferior. The professor out-shot the Indian in every trial. Like every true professor, he began to inquire into the reasons for this, making a number of experiments, the outcome of which was that the white man excelled the Indian solely because his methods were better. There is a profound truth in this result. The civilized man of today is far more efficient than the man of the Old Stone age, chiefly because his methods are superior. The graduate of a medical college handles a case of typhoid, whereas an African conjurer would make a mess of it, the difference being one of technique. And we shall not be far wrong if we say that man has advanced in proportion to the improvements in his methods, particularly in his methods for getting at the facts.

Wells, in his remarkably readable *The Outlines of History* calls attention to the generally recognized fact that the status of astronomical knowledge is an index to the degree of civilization. And the fundamental thing in astronomical affairs is precision in the reckoning of time. This science began with the first efforts of primitive men to keep a date and advanced bit by bit until today the clock and the calendar are so intricately interwoven with our civilization that they could by no possible means be eliminated without destroying the whole fabric. One would have even more chance of keeping his rug after pulling out the warp than of maintaining a civilization without calendars or clocks.

But, you ask, what has this to do with ruins in the United States or elsewhere? It has everything to do with them. All of the earth sciences and all of those having to do directly with man are eternally concerned with time in one form or another. Geology, that dignified and imposing science of the rocks, would be a ghastly chaos without its periods, and what are these periods but marks on the time chart of creation! So, when we set out to study ruins, we are concerned first and last with their time-relations.

In 1909 Mr. Archer M. Huntington expressed himself as sufficiently interested in the prehistory of southwestern United States to finance a systematic survey of the ruins found there, with a view to discovering their time-relations. In other words, men



Photograph by N. C. Nelson

SECTION OF REFUSE HEAP AT PUEBLO BONITO, CHACO CAÑON, NEW MEXICO

Something of the history of any human settlement may be learned by examining the accumulations of débris thrown out from day to day during the life of the community. At Pueblo Bonito, one of the largest and most interesting ruins in the Southwest, and one from which the American Museum possesses extensive collections, the accumulated refuse lying in front of the village forms a long mound measuring about 75 x 500 feet at the base and all of 16 feet in height. In 1916 two separate trial sections were made, of which the above is the highest. The results were disappointing in that the broken pottery, and other industrial remains found showed comparatively little change during the supposedly long process of accumulation. Elsewhere in the Southwest the stylistic changes, for example, in pottery, are often very marked

were to be sent out to seek in these ruins the marks by which they could be arranged in order, according to their ages. So a research staff was organized to grapple with this problem and has been engaged upon it at intervals during all the succeeding years.

At the outset it was conceived that since the earth left telltale marks of its progress in the rocks and sands, so man in and about these ruins must also have left the record, if one could find out how to read it. Just lately, for example, a celebrated European geologist has been touring this country to see how the clays beneath our soil are laid down and he is reading in their hitherto imperceptible lines the successive pulsations of time. So in the case of the ruins, it promises to be but a matter of method, and the Archer M. Huntington Survey may be said to have as its object the discovery of civilization's time clock in the Southwest. Once with its key in our hands we can unravel many of the mysteries of the cliff dweller, the mesa dweller, and the builders of the great pueblos like Bonito and Aztec.

Experience in other parts of the world, particularly in Egypt and western Europe, suggested that the most likely means of dating ruins was to be found in the fragments of pottery scattered about. Pottery is truly an art, for while it has utility, it is at the same time so plastic in origin as to give almost free rein to styles of artistic expression and the use of decorative technique. Further, though pots are easily broken, their pieces are practically indestructible, so whenever and wherever pottery was made, one may find the samples. The record, therefore, is in the simple potsherds, and our problem was to find a method for reading it. Descriptions of technique are apt to be wearisome, so we will content ourselves with a few of the simpler steps in the method of dating ruins by potsherds.

In the first place, where things pile up on the ground, the first to go down will be at the bottom of the heap. In the days of our pioneer forefathers, a cabin was built in the forest, and a clearing made. As the ashes accumulated in the fireplace, they were dumped out behind the cabin. Here also were cast the sweepings from the hearth, bones, broken glass, dishes, etc. So, in the course of time, a considerable heap was formed in which was recorded, in one way and another, the story of what went on in the cabin. Now, it so happens that most of the ruins in southwestern United States are of the community type, that is, they contain a number of rooms, in a few instances as many as five hundred, one to a family. The families usually cast their ashes and sweepings in one place, where from year to year the community dump grew and grew, until in some cases it reached a depth of twenty feet. It was in these dump heaps that our investigators found part of the answer to their questions. Such a deep deposit of ashes and other waste contains several kinds of pottery and of these the oldest is at the bottom and the latest at the top.

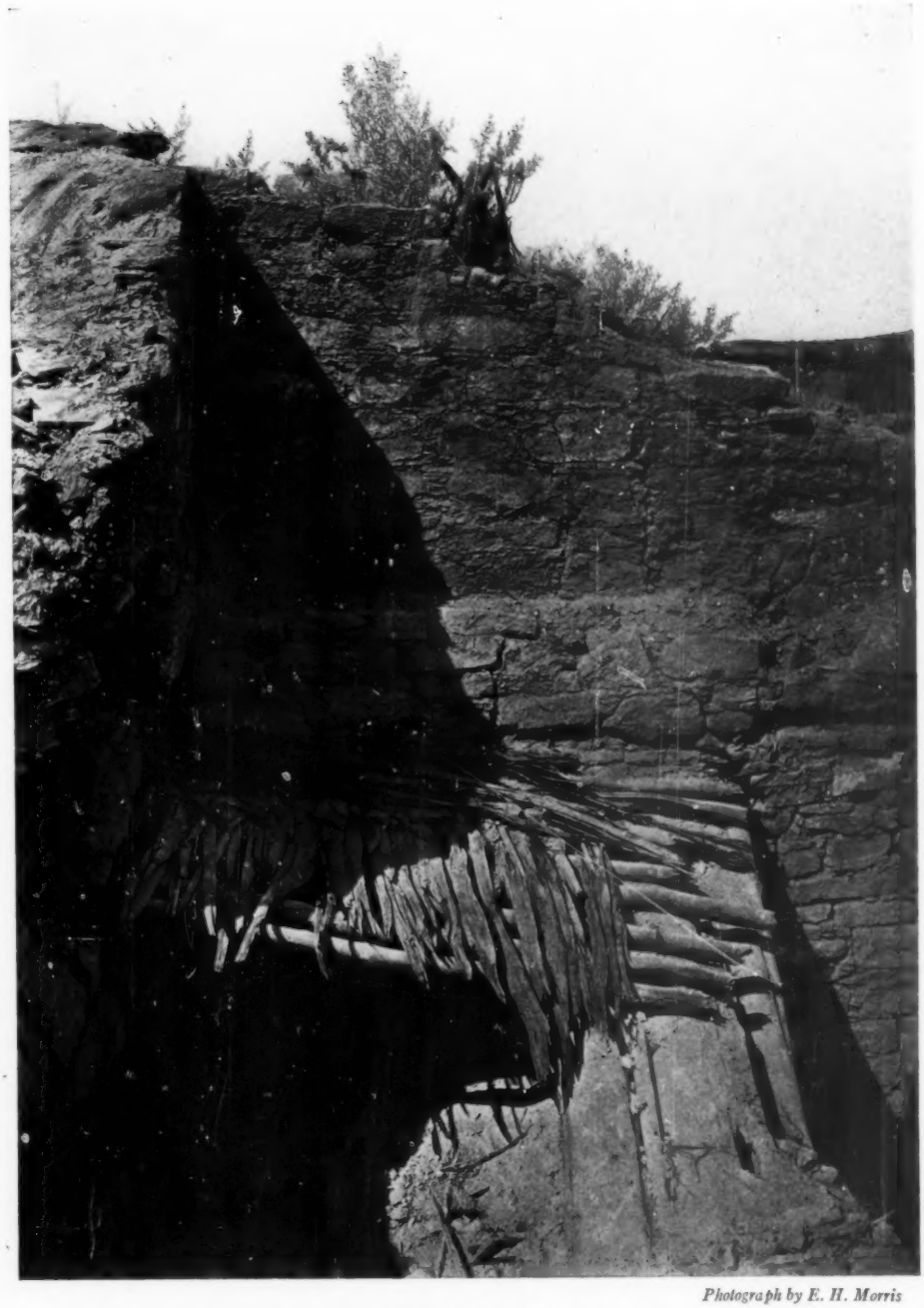
This method of dating, according to which is above and which is below, is, for convenience, called the method of superposition, or the stratigraphic method, because it has some analogy to the earth's strata which the geologist interprets in terms of time.

If the people once living in what is now a ruin in southwestern United States had never moved away and had always rebuilt near the same spot, there would be little difficulty in reading their history. All we would then need to do would be to dig a trench through the accumulated ashes, sweepings, etc., and study the markings and contents of the exposed sections, where everything is laid down more or less successively in order of time. But nowhere is the problem so simple. Every now and then the population shifted. For aught we know, new peoples came as conquerors and evicted the rightful owners.

Photograph by G. H. Pepper

DETAIL OF CEILING IN PUEBLO BONITO

This rectangular room has ceiling beams of pine placed transversely and covered with a layer of willow stalks, which in turn is covered with cedar bast; a four-inch layer of adobe over this formed the floor surface of the room above. The bark-stripped beams and peeled willows give the ceiling the most ornate appearance of any in the pueblo



Photograph by E. H. Morris

CEILING CONSTRUCTION AT THE AZTEC PUEBLO RUIN, NEW MEXICO

The Pueblo Indians from the earliest times to the present appear to have used only two types of ceiling construction, of which the above is the simplest and most common. Heavy timbers up to eighteen inches in diameter served as chief support and were laid usually (not so in the illustration) two or more feet apart and across the long axis of the chamber. Resting on these came a longitudinal course of lighter timbers, placed only a few inches apart. Next above was placed a transverse course of thinly split timbers, or else sticks, laid as close together as possible. This in turn was covered with a layer of twigs, bark, or grass and then capped with a few inches of clay or adobe, pounded down hard. The surface of the adobe, if it was to serve as a floor, was sometimes coated with blood and then smoothed and polished with a stone

Photograph by N. C. Nelson

VILLAGE OF TAOS, NEW MEXICO

This is the northernmost of the Pueblo villages in the Rio Grande Valley and one which has been sufficiently conservative to have preserved for us another type of communal house construction. The village consists of two main buildings, each four or five stories high. These buildings are terraced in the shape of a rough pyramid, in place of being terraced only on the south side, as in the case of Acoma. The doors, windows, and chimneys, as well as the hive-shaped ovens to be seen on the ground level adjoining the buildings, are of European origin. Population in 1910 was about 500

Photograph by N. C. Nelson

VILLAGE OF ZUÑI, NEW MEXICO

This is the largest Indian village in the United States, having a population of about 1700. It is the home town, as it were, of a separate tribe or linguistic stock, many members of which live in outlying settlements during the farming season. The apparent rise of ground on which the village stands is due in part to the accumulated débris of fallen houses surmounted by later constructions. Until recently the building material consisted largely of sun-dried clay or adobe. The fenced areas are garden plots. The Zuñis were the first of the Pueblos to come in contact with the Spanish explorers more than 350 years ago

Photograph by N. C. Nelson

STREET SCENE IN ACOMA, NEW MEXICO

This Keresan village is unique in several respects. It is built on top of an isolated rock about 360 feet high, and has occupied that fortress-like situation since before the white man invaded the country in 1540. Probably, therefore, it is the oldest inhabited community in the United States. Again, this village, housing today about 700 people, preserves for us one of the most highly developed types of ancient Pueblo architecture. Thus it consists of three long, parallel, communal buildings, all facing south, there being no doors or windows in the north wall, which latter rise sheer two or more stories, as seen in the left of the picture. In the foreground at the east end of the principal "street" may be seen the water reservoir, occupying a hollow in the surface of the great rock. This stronghold was stormed and partly burned by the Spanish in 1598

Photograph by N. C. Nelson

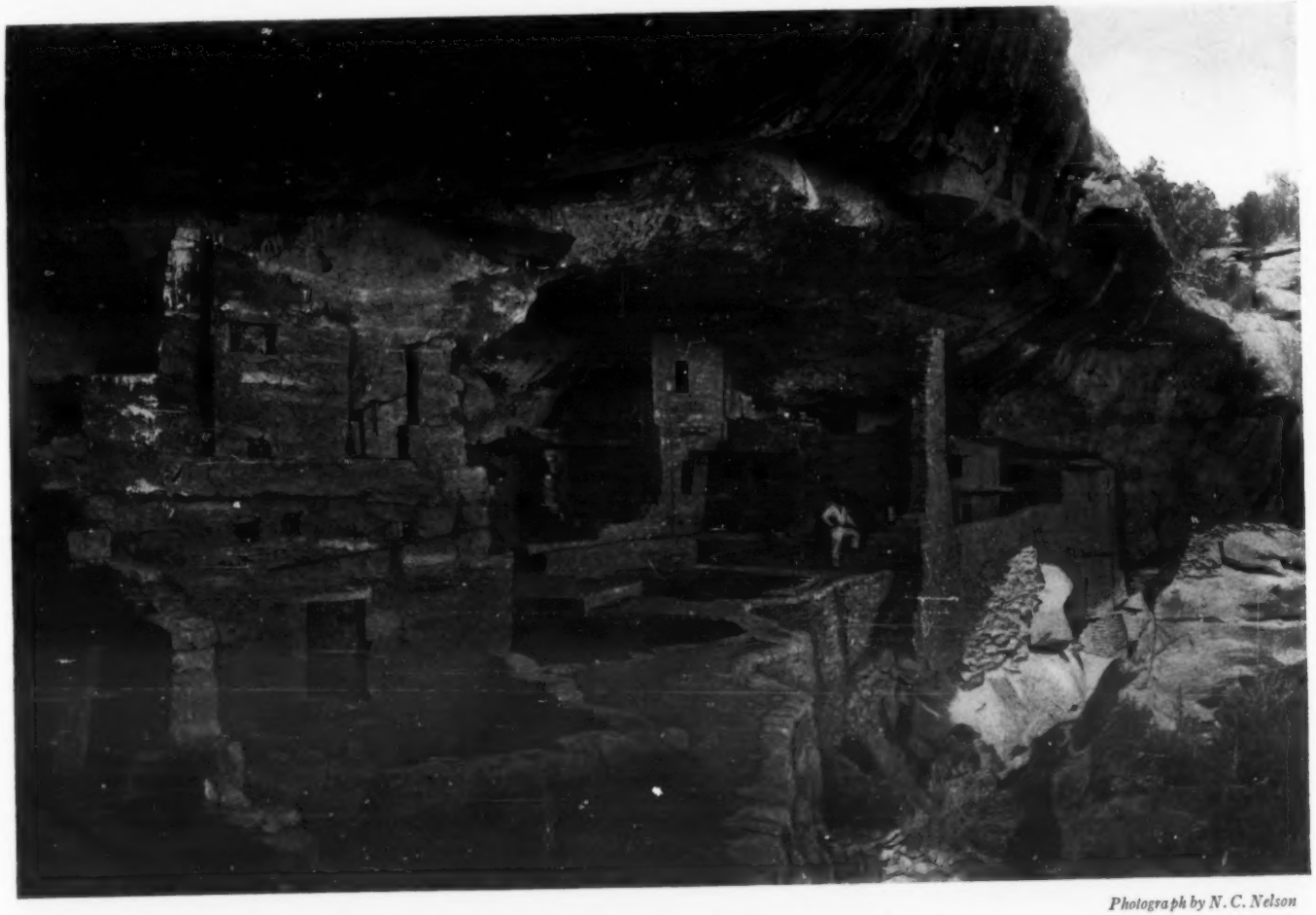
VILLAGE OF LAGUNA, NEW MEXICO

This village was founded in historic times, which partly accounts for its lack of architectural compactness. Thus here, in addition to the modern doors and windows, we see isolated one-story houses, strongly suggestive of the breaking up of the communal form of organization. To this might be added the further fact that the greater number of the population credited to this village, 1441, actually live in small outlying settlements, all far more favorably situated for agriculture and stock raising than is the home village itself

Photograph by N. C. Nelson

SPRUCE TREE HOUSE, MESA VERDE, COLORADO

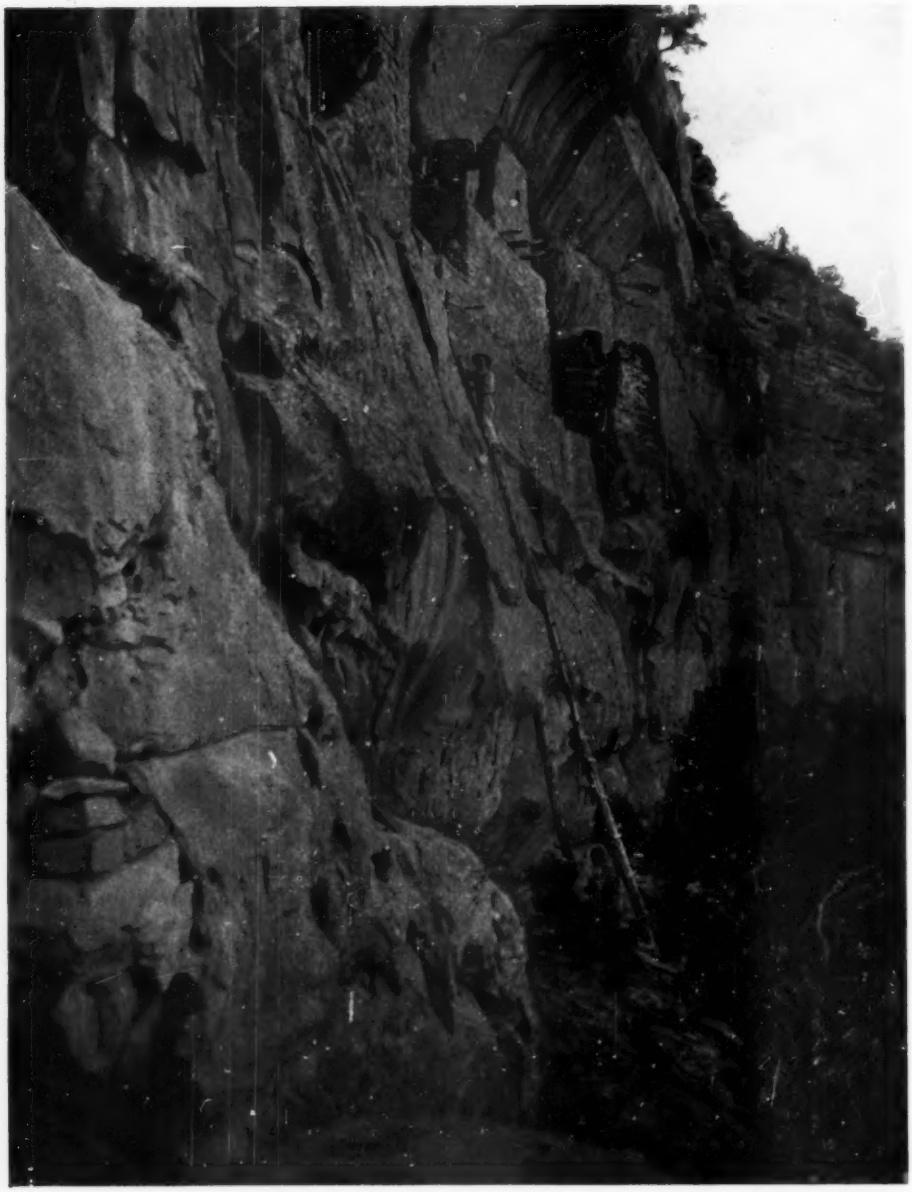
Of the several large cliff houses in the Mesa Verde National Park, Spruce Tree House is the most picturesque with respect to situation and is, besides, a fine example of this type of habitation. The ruin was discovered by members of the Wetherill family of Mancos, Colorado, in 1888; it was partly excavated by Baron G. Nordenskiöld, of Stockholm, in 1891, and in 1908, was completely cleared and repaired by Dr. J. W. Fewkes, of the Bureau of American Ethnology. The ruin occupies a shallow natural cave, 89 feet deep and 216 feet long. It contains 114 secular and 8 ceremonial rooms, and it is estimated that it accommodated a population of about 350



Photograph by N. C. Nelson

BALCONY HOUSE, MESA VERDE, COLORADO

Balcony House, so named from the shelf or veranda on the second-story level seen near the extreme right of the picture, is regarded as exhibiting the highest architectural achievements of the Mesa Verde cliff dwellers. It is one of the best preserved ruins of the communal cliff-dweller type, several of the twenty-five rooms being intact. A retaining wall, in places raised high enough to serve as a balustrade, is to be seen along the front of the cave, keeping enemies out and preventing the younger inmates from falling into the deep chasm below



Photograph by N. C. Nelson

CLIMBING TO "INACCESSIBLE HOUSE," MESA VERDE, COLORADO

The manner in which the original cliff dwellers reached their most secure abodes is not always apparent. In some places, where no natural edge gave access, traces of steps cut in the living rock remain; elsewhere, small holes sufficiently large for the insertion of the toes and the grip of the fingers have been chiseled into the steep face of the cliff, sometimes along a horizontal and sometimes along a vertical line. Commonly, however, there is no evidence whatever either of natural or artificial approaches, and we must suppose that the inhabitants entered by means of ladders. To reach some of these eyries is one of the exhilarating features of a trip to the cliff-dweller regions

Anyway, what we do find is that some ruins were occupied for a very long time, others for but a brief time, but none of them for all of the time. So, to get a time chart for the Southwest as a whole, the results obtained from many, many different ruins must be patiently pieced together and by precise methods. Just how this was done is a long but interesting story, but what we are now concerned with are some of the results obtained by the use of these methods.

Before going on we should note that the Archer M. Huntington Survey is making use of other methods of estimating time. Many of the ruins encountered still hold the spruce and cedar logs used to support the ceilings. Now, it so happened that a specialist in the growth of trees had devised a method by which he could tell whether the trees from which logs were cut were growing at the same time, or to what extent their life periods overlapped. This again is a triumph in the precision of method by which the annual growth rings of the trees are read as time charts. So the logs in the ruins were subjected to these methods and some interesting things found out. For instance, all the logs in the great ruin at the town of Aztec, New Mexico, seem to have been cut within a span of nine years or less, which would mean that the whole of the great building, with its four hundred or more rooms, was planned in advance and built with astonishing speed, when we take into consideration that all of these timbers were worked with stone tools and the stones of the walls dressed by pecking with sharp-pointed pebbles. But this is not all, for timbers from the great ruin of Bonito in the Chaco are being compared with those from Aztec to see which ruin is the older. From the results so far, it appears that Bonito is the older by at least a quarter of a century. The work, however, has not yet gone far enough for us to be certain of this. All that we need note here is that where timbers are preserved we can even read the time records in their cross sections. Professor A. E. Douglass, the discoverer of this remarkable method, explains in another article just how the thing is done and shows us how he measures the growth of living trees. Our only point here is that this is another improvement in our methods for dating ruins in the Southwest and was first applied to them by the Archer M. Huntington Survey.

It may be that the work of this Survey has not gone far enough to give us the outlines of man's career in the Southwest, but it can give it with some precision for two large areas in which the most intensive work was done. One of these areas is in the vicinity of Santa Fe, along the Rio Grande in the state of New Mexico, the other is the extreme northwestern part of the state and the adjoining parts of Arizona, Utah, and Colorado, or the basin of the San Juan River. A glance at a map will show that these two areas stand as two large samples of the central area of Pueblo Indian culture and so may be considered representative of the whole. Fortunately, other investigators are working in adjacent fields so that the results of all can be coördinated, thus giving us, for the first time, a chronology for this prehistoric wonderland of our country. Since, as we hinted at the outset, the best indexes to time differences are the changing styles of pottery, so the large historical periods under which the ruins are grouped are named in terms of pottery. This does not mean that these styles of pottery are the only distinguishing characteristics between the periods; each of them can be checked with architectural features, for example, but pottery characters are the most accessible and lend themselves most readily to the method of superposition. So remembering that the successive styles of pottery are merely indexes, and that by them we can determine the time sequence in the historical development of the Indian in the South-

west, the periods in the following chronological table will be understood:

(7) The Historic Period (1540–1921); pottery index, Two-Color Glazed Ware, modern type.
(6) Period of Three-Color Glazed and Painted Wares (?–1540); this is the latest prehistoric period.
(5) Period of Two-Color Glazed Wares, early type.
(4) Late Period of Two-Color Painted Wares.
(3) Early Period of Two-Color Painted Ware.
(2) The Pre-Pueblo Period, crude pottery only.
(1) The Initial Period, or Basket Makers, pottery generally absent.

One of the first things to strike us in this table is that the historic period begins in 1540 and that all before that is prehistoric. This may sound strange, for in the Old World prehistoric often means earlier than a few thousand years B. C. Yet, since the first visitor to the region we are now considering came in 1540, that is when its real history begins. All this serves to show how arbitrary and artificial is the distinction between what is history and what is prehistory. Although six of the seven periods outlined above cannot be dated in the strict sense of the word, we can nevertheless give their relative time-relations, for we can prove one to have come after the other. We can go even further and estimate the length of the periods as shorter or longer in proportion to the territory they cover and the number and variety of their remains. Yet, the details of this cannot be entered into now.

When the first Spanish expedition came on the scene in 1540, they found Indians living in large houses, just as they do today, the Hopi, Zuñi, and the many tribes about Santa Fe which, for convenience, we designate as Rio Grande Pueblos. These are the people of the historic period (7), and it is from the study of them that we can the more readily understand the preceding periods. For example, in 1540 no such people were living anywhere in the valley of the San Juan where we find the great ruins like Aztec and Bonito, excavated by the American Museum; in fact, these great ruins belong to Period 4 in our table, and so far no ruins have been found in that area that fall in any of the later periods, although some of the ruins belong to Period 3 and some to Period 2. On the other hand, we know that the people who, in Period 5, built the ruins farther east, around the upper Rio Grande, copied largely from the older inhabitants of Aztec and Bonito. Anyway, they had the same styles of pottery and the same architectural ideas. This is one of the many interesting points brought out by the Huntington Survey and it means that, in the earlier prehistoric periods, what we know as modern Pueblo culture had its beginnings in the region of the San Juan or that part of the United States adjacent to the four corners of Arizona, New Mexico, Utah, and Colorado. Then, for some reason, the center of culture shifted eastward to the valley of the Rio Grande, with a few outposts elsewhere. Probably it was the same kind of a shift as that from Greece to Rome, or better still, like the movements in civilization that left the glorious Babylon a wreck in the desert.

The cliff houses about which so much has been written and which so stir the imagination are all in and about this same San Juan country. These also belong to Period 4, and some of the houses in what is now Mesa Verde Park were almost contemporary to the great ruins of Aztec and Bonito. Perhaps some of them were earlier; that remains to be found out. Certainly many of the cliff houses of the adjacent parts of Utah are earlier, falling at the opening of this period.

There are many other interesting points in the story of the Southwest, some of which are shown in the arrange-

Photograph by G. H. Pepper

PUEBLO BONITO, CHACO CAÑON, NEW MEXICO

This photograph taken from the cliff shows the west third of the ruin partly excavated. In the foreground may be seen under construction the field laboratory of the expedition

ment of the collections in the American Museum. The attainment of the above chronological outline and the perfecting of the methods noted for reading the time-relations of ruins has been a slow and laborious process and is, like most things of this kind, not the work of a single individual. A number of investigators have given their best efforts to the problem, but the Huntington Survey has predominated in the two regions noted, the San Juan and the east Rio Grande district, through the work of Mr. N. C. Nelson and Mr. E. H. Morris, of the American Museum staff. The work now under way promises to reveal the subdivisions of the periods given in our table and thus render our dating more exact. It seems clear then, that the Archer M. Huntington Survey will in the end contribute something precise and definite to the story of man in prehistoric America. It has already given us better methods and, as we have seen, the attainment of better methods promises new triumphs.

Two fine examples of two-color painted ware from Pueblo Bonito. The colors are black and creamy white

A PAINTED TABLET OF WOOD

From the ruined pueblo of Bonito, New Mexico. The Hyde Expedition

DATING OUR PREHISTORIC RUINS

HOW GROWTH RINGS IN TIMBERS AID IN ESTABLISHING THE RELATIVE AGES OF THE RUINED PUEBLOS OF THE SOUTHWEST

BY

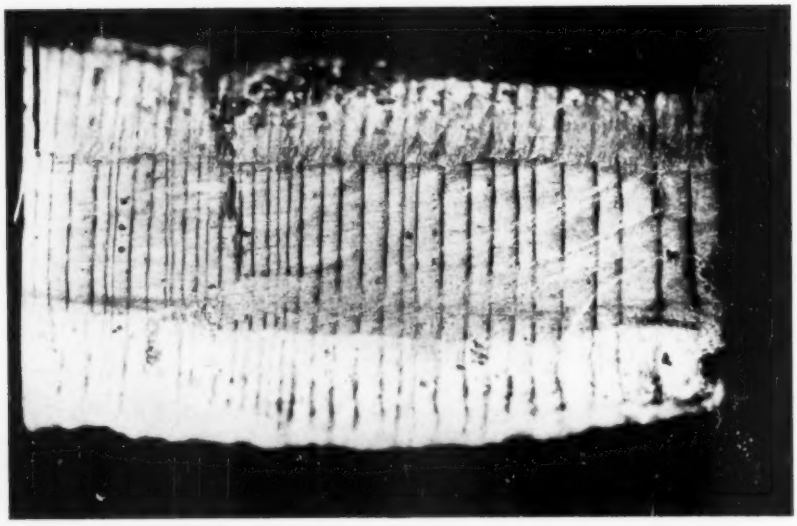
A. E. DOUGLASS*

THE freedom from undergrowth of the pine trees of northern Arizona and their exposure to the characteristic drouths of the country, first suggested to the writer the idea that their chief variations in growth had a climatic origin. Accordingly a long search was made for evidence of climatic effects, which has resulted in the identification, dating, and measurement of more than 100,000 rings in nearly 400 different trees. Many interesting results have been obtained, and an extensive technique of ring-study has been developed. Of that technique the most important feature of present interest is the cross-identification of the growth rings in the different timbers. This was first developed in 1911 in studying trees near Prescott, Arizona, where it was found that nineteen trees out of twenty had ring systems showing marked resemblance to one another. This gave additional confidence in the yearly identity of the rings and the climatic character of their major variations. The extent of area over which this extreme similarity is found may be only a half mile, as in the mountainous region near Prescott, or 50 miles as found between groups in the Sequoia region, or even more than 200 miles, as shown between Flagstaff, Arizona, and Durango, Colorado. Occasional rings of extreme character are found to be alike in the Sequoias of California and in the pines of Arizona, 450 miles away. Very rare rings have been traced across 750 miles of country.

In 1915 Dr. Clark Wissler wrote a letter expressing interest in the study of tree rings and offering sections of beams from ruins in New Mexico. The offer was gladly accepted and a selection was made at once from beams, from surrounding trees, and from trees growing in ruins. From these specimens it was evident that pine and spruce beams were very good for this study, while juniper often was very disappointing. In 1918 Mr. Earl H. Morris, working in the Aztec ruins for the American Museum, sent six sections from Aztec and three from Pueblo Bonito, in Chaco Cañon. The six from Aztec were immediately found to cross-identify, three or four of them very well and the other two or three only fairly. The three from Chaco Cañon have not yet been identified.

Part of this was very encouraging, and in August, 1919, I visited Aztec in order to plan more satisfactorily the next step. I found that the sections had come from a pile of loose beams whose exact locations in the ruins were not known. It was immediately evident that the location of each beam should be known and that a way must be devised to get the rings without injuring the floor beams or other parts of the structure still in a good state of preservation. Accordingly soon after this visit I had special borers made of steel tubing, one inch in diameter, with saw teeth at the one end and brace attachment at the other. Small teeth, some ten to the inch, have proved better for dry beams than coarse teeth of twice that size. These borers were tried out at the laboratory in Tucson and the fine-toothed one sent to Mr. Morris. With patience and skill he has used this borer on the beams at Aztec and obtained for me cores from twenty-six beams located in sixteen different rooms, without injury to the ancient construction of the building.

*Professor of Physics and Astronomy, University of Arizona



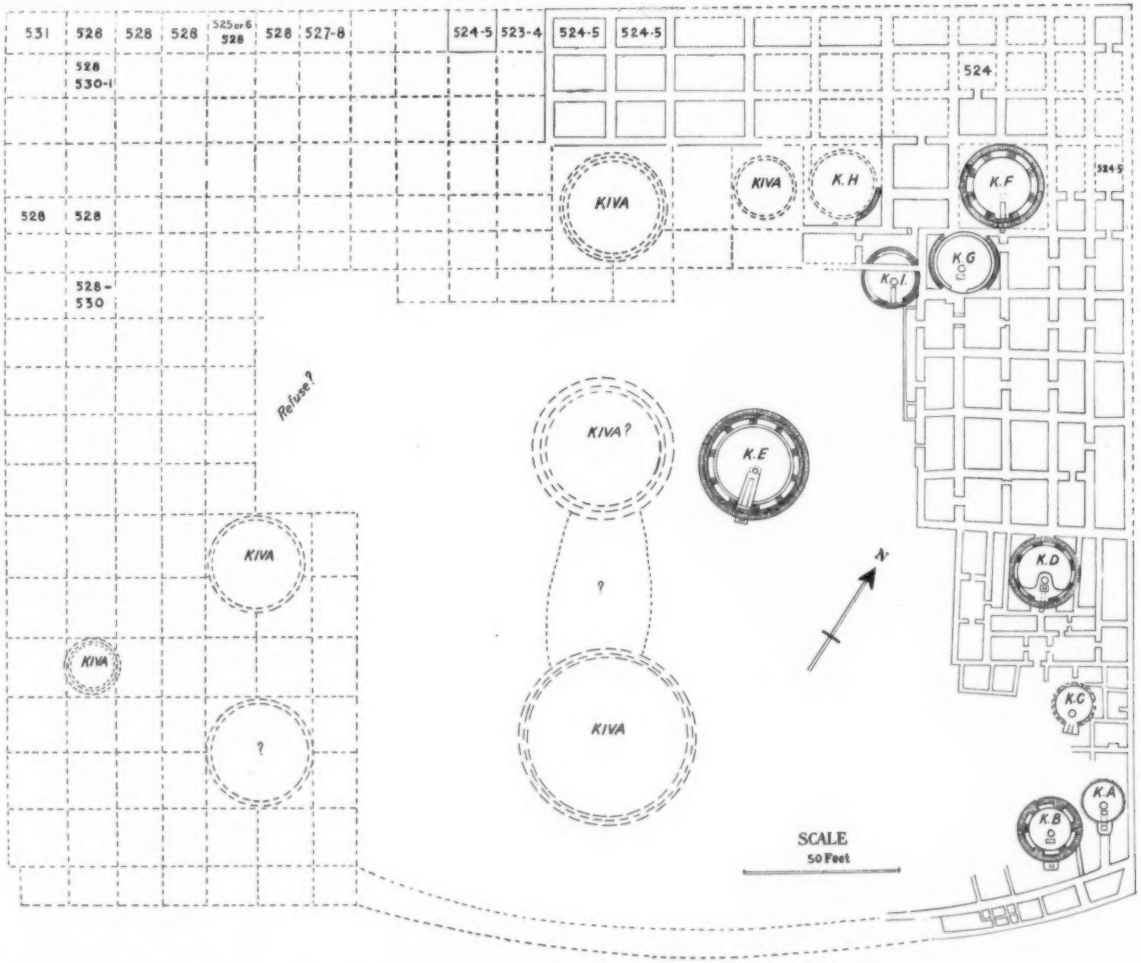
Core from northwest corner room at Aztec, showing latest cutting date, R.D. 531. Three black dots (really pin pricks in the wood) form the century mark, one dot indicates the decade. (Twice natural size)

I obtained finally the ring-records of thirty-seven different beams, of which thirty-two were accurately located in the ruins. About twenty different rooms were included, passing across the large north portion of this great 450-room building. The cross-identification in nearly all was perfectly easy and satisfactory and the relative dates of cutting the timber ascertained. In order to express these conveniently a purely hypothetical date, R. D. (Relative Date) 500, was assumed for one of the larger of the outer rings and all dates expressed with reference to that year, whatever the real date in our era may have been.

It will be seen from the diagram that nine years will cover the time of cutting the various timbers examined and that it was not continuous. The principal cutting years were R. D. 524–25 and 528. The builders probably worked in the forest in the colder part of the year and obtained enough logs to last two or three years. These were used until nearly or entirely exhausted, when more were obtained.

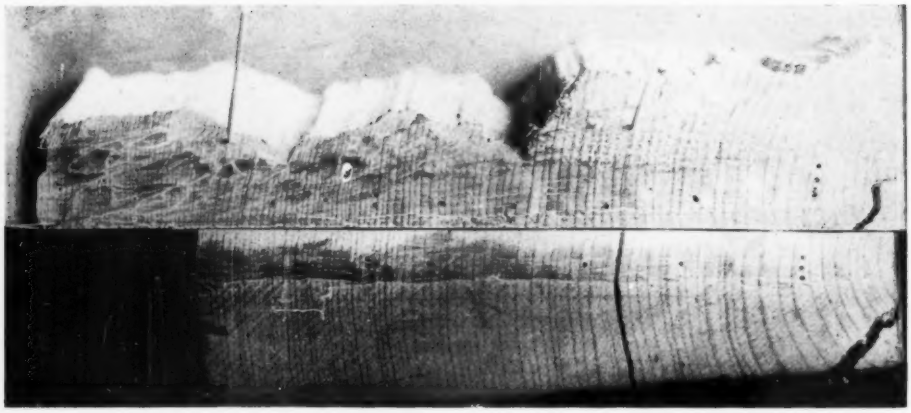
As a result of this study, the beams brought back to the American Museum by the Hyde Expedition to Chaco Cañon, twenty-five years ago, were examined and sections cut from seven. Of these one was cedar and could not be interpreted and one was a small pole used in pueblo floor construction to lay upon the beams. Two were posts, the rest ceiling beams. It was noticed that a peculiar sequence of rings occurred near the outside of each. This made the determination of the relative cutting dates in this group very easy. Then it was recollected that a similar sequence existed in the Aztec beams. Upon careful comparison the cross-identification between these ruins became absolutely convincing. Similarity was found for the years R. D. 480–84, 475, 470, 461, 454, 448 or 449, 435, 432, 427, 423, 418, 408, 406, 402, 393–95, etc. There is no doubt that the beams in Aztec and Pueblo Bonito were living trees together during more than a hundred years and that the cutting of the timbers for Aztec followed that for Pueblo Bonito by from forty to forty-five years.

Finally one beam from Peñasco Blanco, a few miles down the Cañon from Pueblo Bonito, appears to have



PLAN OF THE AZTEC RUIN

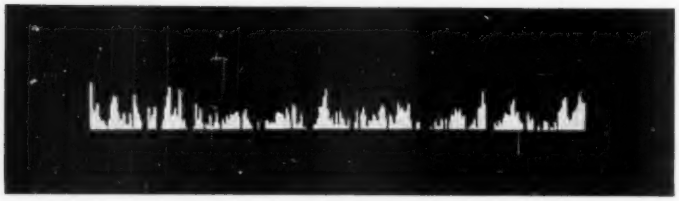
This shows the location of the dated beams, with the relative dates of the cutting of the timbers, and the condition of the excavations at the end of 1917. Much has been done since



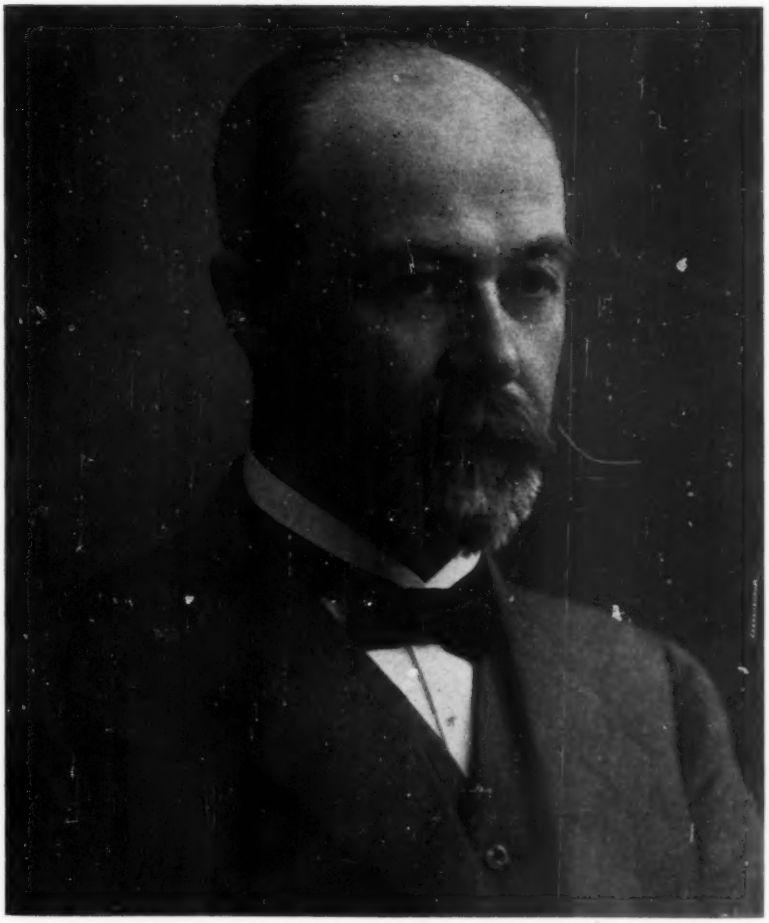
Sections of two beams, the upper from Aztec and the lower from Pueblo Bonito, placed side by side with their rings matching, to show how much the Aztec timbers grew after the Pueblo Bonito timbers had been cut

been cut about twenty years after the greater number of the Pueblo Bonito beams. Two of these Pueblo Bonito beams are from identified rooms, namely 32 and 36 as numbered by the Hyde Expedition.

In conclusion I should state that an extensive study has been made of the types of growth records which most nearly resemble the rainfall periods in localities near by and very careful selection and weighting of the Aztec and Pueblo Bonito curves of tree growth have been completed. The resulting curves have been combined and standardized and show yearly growth as in the accompanying figure. This curve undoubtedly gives us a fair idea of rainfall variations near this ruin during the two centuries preceding its construction. There is reason to hope that by the aid of the Sequoias it may sometime become possible to determine just how long ago this particular sequence of variations occurred in northwest New Mexico.



Tree growth at Aztec and Pueblo Bonito from R.D. 288 to R.D. 527, arranged to test climatic periods by an optical method



Baron Gerard De Geer, Professor of Geology, University of Stockholm

BARON GERARD DE GEER AND HIS WORK

BY

JAMES F. KEMP*

AMERICAN and Canadian geologists and many others interested in geological science have recently had the great pleasure and privilege of welcoming on this side of the Atlantic Baron Gerard De Geer, past-president of the International Geological Congress of 1910, professor of geology in the University of Stockholm, and foremost among the European investigators of the great Ice Age. Baron and Baroness De Geer, with two experienced assistants, have been applying in Canada and the northeastern United States the methods of investigation already carried by them to an almost perfect technique in Scandinavia. Very promising results are indicated, and in Canada and the United States the full publication of the report of the expedition will be awaited with deep interest. Geologists in these two countries have already profited greatly by field trips, conferences, and lectures extended by our distinguished visitors.

Baron De Geer is now in his sixty-

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third year. His university training was gained in the ancient seat of learning of Sweden, Upsala, where the traditions of Linnæus and Berzelius still linger. While yet a candidate for his degree, he began his work on the Swedish Geological Survey in 1878, and soon became especially attracted by the problems presented by the moraines, sands, and clays left by the retreating continental glacier in the geological times just preceding our own. In 1882 he made the first of five trips to Spitzbergen, then a No Man's Land in the Polar sea. In 1896, 1898, and 1901 he went again, and in 1910 he conducted a large party from the International Congress of that year. The Spitzbergen work has thrown a flood of light on the geological formations of this far northern land and has given a clue to the structure and large tectonics not alone of the islands but of the North Atlantic ocean bottom, as well.

Baron De Geer's most interesting results have been attained, however, in the study of the laminated clays which were deposited in many parts of Sweden from south to north. It appears that the melting and retreating continental glacier backed up in front of it extended bodies of fresh water, which often reached considerable depths next the ice itself. Into these waters the sediment-laden streams, fed by the melting ice, poured from tunnels in the bottom of the glacier just as they do now from the fronts of glaciers resting on the surface in the valleys of the Alps and elsewhere. In the warm seasons the melting was great and the supply copious; in the winter the melting ceased and the streams failed. Following the cold months the supply of water and suspended sediment was renewed and passed through the annual cycle of the seasons. The sediments in the cold and heavy waters spread out over the lake bottom and, as they settled, produced widely extended deposits of laminated clays.

The laminated clays thus were laid down in annual layers of the same significance as are the rings of growth in a tree trunk. As melting waned in the autumn, the amount and coarseness of the sediment fell off, giving a layer of fine, fat clay, which is easily recognizable and which marks the close of a year's work. By its aid the annual increments can be detected, measured in thickness, and counted. They vary widely. Some may reach six inches when the summer was unusually hot and melting was copious. Some may be only an inch or even less, corresponding to cold summers which may have been occasioned by sun spots. When the annual layers have been measured by ingenious and expeditious methods, the thickness of each one can be represented to scale by a vertical line, and the lines can be drawn in series, standing one half centimeter apart upon one base line for a long series of years or measurements. When the summits of these vertical lines are connected, a saw-tooth curve results which practically shows the ups and downs of the seasons, the very hot ones being shown by high summits in the curve, the very cold ones by low notches.

After years of work in developing these methods, Baron De Geer realized that, of the markedly hot seasons, each prevailed over a wide area, and would be recognizable by its especially high summit in the curves which were plotted for separated places perhaps many miles apart. The summit was necessarily preceded and followed by characteristic ups and downs. Matching the curves soon revealed such startling uniformity that individual years could be correlated without an appreciable chance of error. Still more remarkable was the later discovery that curves taken in Finland across the Baltic Sea and the Gulf of Bothnia, as well as others over the mountainous divide in Norway, could be matched with those established in Sweden, and the same years in each could be recognized. Now comes the question, can they not also be matched and compared with those taken in North Amer-

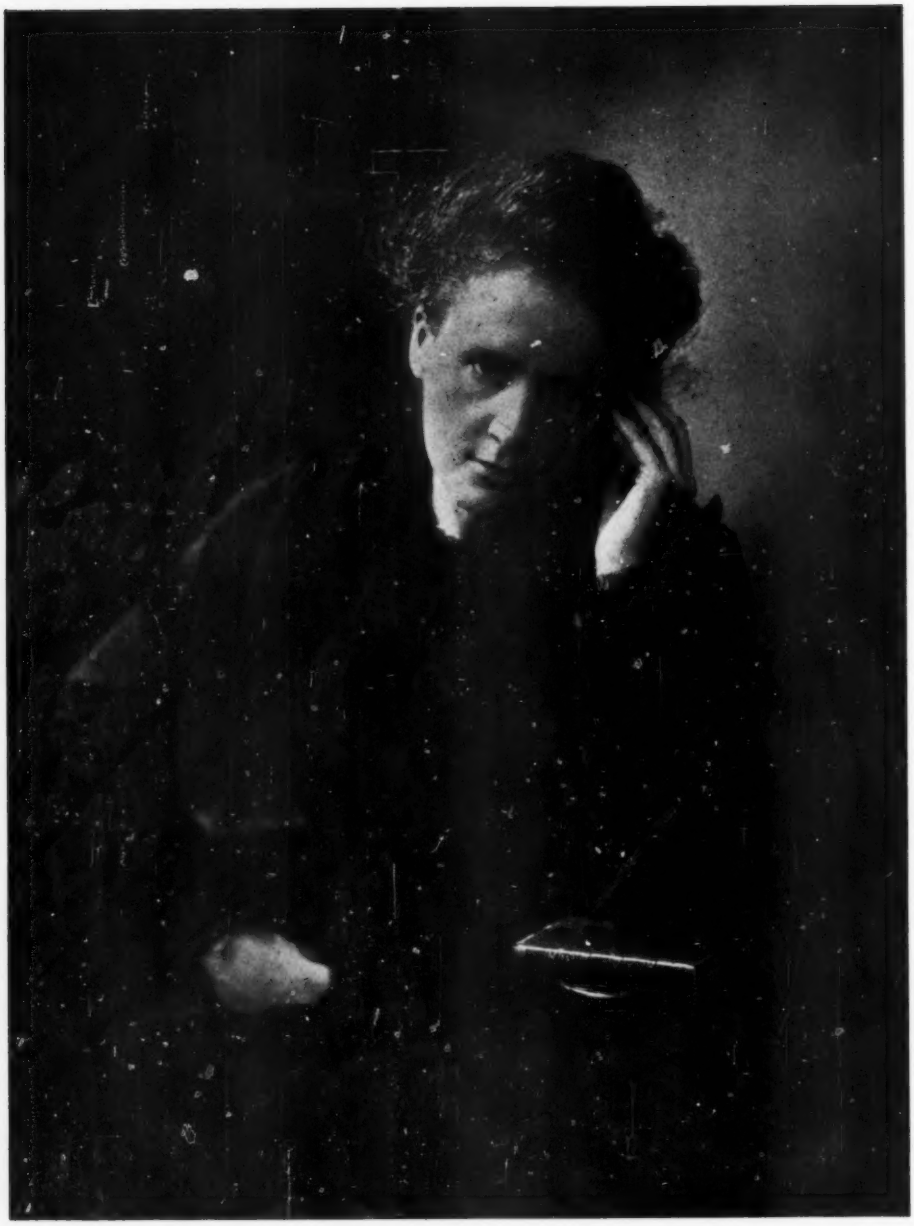
ica, since study of comparative meteorological records today brings out a practical uniformity in hot years and cold years on both sides of the Atlantic.

Baron De Geer was therefore moved to come to America, measure as many exposures of laminated clays as possible, plot the curves, and compare them with his series of similar ones in Scandinavia. In the four months since his arrival in August last he has found exposures of much interest in Vermont, Quebec, Ontario, Wisconsin, New York, and in the Connecticut Valley of the New England States. In the elaboration of the details he will be greatly aided by his assistants, Dr. Ernst Antevs and Dr. Ragnar Lidén. The former is spending a year in the United States, working over the problems during the closed season at one or two of the American universities, and with the coöperation of American and Canadian friends and colleagues, will resume field work when the warm weather comes around again. Should the establishment of correlated years result for both sides of the Atlantic it would be a great step forward.

In Sweden Baron De Geer has reached a measurement of about 13,500 years for the retreat of the continental glacier across Sweden. For the first portion of the time of retreat, which is represented by the area lying between the terminal moraine in Denmark and Germany, and which is partly beneath the North Sea, measurements are less accessible than for the succeeding stages. The latter are, however, almost, if not quite as accurate as if he could have counted the rings of growth on a gigantic, long-lived tree. In southern and central Sweden 5000 years have been established, with an almost negligible limit of possible error, and in northern Sweden 8500 years with a possible error of one or two centuries.

Various interesting corollaries follow. For instance, a deposit of prehistoric flint implements has been found on a delta in Sweden whose relations with known laminated clays can be made out, giving a pretty accurate clue to the number of years ago that primitive users of flint followed the retreating ice into Sweden. Again, the continental glacier extinguished plant life, and, on its retreat, gradually the vegetation followed it northward. The actual number of years can now be quite closely made out, and the time required to change inhospitable sands, gravels, and clays to soils capable of supporting the present plants and trees can be determined. A chronology is afforded for the distribution not alone of plants, but of animals as well. Should a parallel chronology result for America, we shall be able to check the estimates of time already based on the retreat of the crest of Niagara Falls, on the retreat of the Falls of Minnehaha, of the Mississippi, and the one or two local attempts by American observers to count clay layers in single localities.

NOTE.—The arrangements for the trip of Baron De Geer and his party through the United States and Canada were under the general charge of the American-Scandinavian Foundation, with coöperation from the International Educational Alliance. The following groups of American and Canadian geologists cordially joined in making the trip a success: President Henry F. Osborn, of the American Museum of Natural History; Director George Otis Smith, of the United States Geological Survey; Dr. I. C. White, president of the Geological Society of America; Vice Chancellor Adams, of McGill University; President Branner, of Stanford University; Professor Chamberlin, of Chicago University; Professor Coleman, of Toronto University; Dr. W. O. Hotchkiss, director of the Wisconsin Survey; Professors Kemp and Luquer, of Columbia University; Dr. Leverett, of the United States Geological Survey; Professor Lindgren, of the Massachusetts Institute of Technology; Professor Scott, of Princeton; Dr. Upham, of Minneapolis; and Professor Woodworth, of Harvard. An executive committee consisting of Consul General Lamm, of Sweden, Mr. John G. Bergquist, Dr. I. C. White, Dr. Waldemar Lindgren, Dr. H. G. Leach, president of the American-Scandinavian Foundation, with Dr. J. F. Kemp as chairman, gave attention to the details. Baron De Geer lectured at Chicago, Columbia, Cornell, Harvard, and Michigan universities; and before the American Geographical Society, the American Philosophical Society, the Carnegie Institution, the National Academy of Sciences, and the New York Academy of Sciences. At the annual meeting of the last-named he was elected one of the limited number of Honorary Members.



M. Curie

MARIE SKLODOWSKA CURIE

BY

GEORGE F. KUNZ

RADIUM, discovered in 1898 by Mme. Curie in association with her husband, Pierre Curie, marked an epoch in the development of physical science, for the wonderful phenomena shown by this strange element seem destined to revolutionize our conception of the material universe.

It was Mme. Curie who took the initiative in the researches leading to this discovery, following the indications offered by some experiments on uranium made by Henri Becquerel, and in coöperation with her husband she carried on the investigation step by step until it resulted in the great discovery. She was born in Warsaw, Russian Poland, November 7, 1867, and is the daughter of Ladislaus Sklodowski, professor of physics and chemistry in the University of Warsaw. In 1891 she went to Paris, where, in 1893, she received a licentiate's degree in mathematics, and in 1895 a degree in physical and chemical sciences. She soon after became instructor in physics at the high school of Sévres. In 1908, two years after her husband's death, she was appointed chief professor of physics in the Sorbonne (Université de Paris). In conjunction with her husband and with Henri Becquerel, she was awarded in 1903 the Nobel Prize in physics, and in 1911, the Nobel Prize in chemistry was awarded to her alone.

When Mme. Curie's visit to the United States was announced, her many admirers were united in the wish to offer her some notable testimonial of their regard. While this recognition of her work was highly appreciated by her, she steadfastly refused all proffers of a fund for her personal use, but in the spirit of the true scientist, she consented to accept the gift of one gram of radium, which she could use for her experiments.

Contributions toward the Marie Curie Radium Fund, organized for the purpose of making such a gift possible, may be sent to the Equitable Trust Company, Treasurer, 37 Wall Street, New York City. One gram of radium costs $100,000; thus far $78,000 have been raised.

The ceremonies attending the presentation of the radium to Mme. Curie will take place at 4 P.M. on May 20, 1921, in the White House, Washington. President Harding himself will make the presentation.

A reception in honor of Mme. Curie, which will be held in the auditorium of the American Museum on the evening of Tuesday, May 17, at 8:15, is being arranged by the American Museum of Natural History, the New York Academy of Sciences, and the New York Mineralogical Club, which have selected from their membership the following representatives to act as a reception committee: Dr. Henry Fairfield Osborn, Dr. Frank M. Chapman, Dr. William J. Gies, Dr. Edmund O. Hovey, Dr. D. Willis James, Mr. Ivan O. Lee, Dr. Frederic A. Lucas, Dr. William D. Matthew, Prof. Alexander H. Phillips, Dr. Edward L. Thorndike, Dr. Ralph W. Tower, Mr. Herbert P. Whitlock, Dr. George F. Kunz.

Mme. Curie will speak on this occasion and, in addition, addresses will be made by Professor Michael Ivorsky Pupin, Dr. George B. Pegram, Professor Alexander H. Phillips, President Henry Fairfield Osborn, Dr. Robert Abbe, Dr. Francis Carter Wood, and Dr. George F. Kunz.

An important collection of radio-active minerals will be exhibited in the west wing of the American Museum, comprising a full series from the magnificent Morgan Collection of the museum, supplemented by interesting specimens from the private collections of the members of the New York Mineralogical Club, and minerals and apparatus, both physical and medical, loaned by other institutions and individuals. Some interesting literature relating to the history of radium will also be shown. The exhibition will be opened the night of the meeting and will continue indefinitely thereafter.

APPROACHING TUBANO FROM THE SOUTH ALONG THE WELL TRAVELED TRAIL

BIRD COLLECTING IN THE HIGHLANDS OF SANTO DOMINGO*

BY

ROLLO H. BECK

I ARRIVED in Santo Domingo City in the fall of 1916 direct from a South American bird collecting trip, with instructions to reach, if possible, the higher portions of the island of Santo Domingo. The presence, however, of American marines in full control of the city and the reports of bands of insurrectionists in various parts of the country made immediate compliance with the instructions out of the question. After consulting the military commander, I collected about the city for a couple of months, crossing the river to visit promising ground on the other side and hiring a boat to go up the river a few miles. I also worked the wilder plantations outside the city limits. One day, while walking along the river bank, I heard shooting on the other side and saw natives running along the far bank and disappearing in the brush; sailors from the warship on the river pulled hurriedly for shore and hastened up the main street of the village. Later in the day I learned that two American officers had been shot by natives who had escaped in the thick brush that surrounded the village.

Prudence suggested that I circumscribe my going and coming still more, so much so that I packed up one day and took the steamer for Sanchez on the north side of the island. The marines at this post and the native population seemed to be on friendly terms, so a visit to La Vega, a town forty miles inland, was planned. Here conditions were more strained and a guard was sometimes placed at the entrance to the country roads to search incomers for firearms.

At this place I discarded my khaki shirt and pants and bought a cheap native outfit. Attired in the blue denim, soaked from hours of rain, and sloshing along through mud puddles and pools of water on one of the less frequented lanes, I, no doubt, looked like a *mal hombre* (bad man), as one native muttered when in the morning I passed his hut at a rapid stride, headed for the hills. At any rate, my looks were not reassuring to one of the young marines who was occupying the post on my trail as I neared town. He wanted to know where I was going, and whether I had a permit for the gun, but he allowed me to proceed when I mentioned his Major's name and offered to show his signature to my pass. A battle took place twenty miles from La Vega a few days later between marines and natives, but my peregrinations about the country were not interrupted. Completing my work in the vicinity, I returned to Santo Domingo.

Quiet reigning there, I left for Azua, where a guide and mules were hired and the trip to the higher parts of the island was begun. We started before daylight and were well on our way by sunrise. The call of the burrowing owl by the roadside gave way to the cooing of doves as we passed a stream of water and headed out through the brushy lowlands toward the rolling hills in the distance. Wild guinea fowl crossed the road on foot once or twice ahead of us and one covey lost a member, as the twenty gauge was ready when they flushed from the side of the road at our approach. By noon we had reached a small brook of warm water but it was late afternoon before we arrived at our destination, the village of Tubano, where the search for specimens was to begin. Tubano consists of a couple of dozen houses, two stores, and a church, and is located in a little valley on the south side of the Rio de los Cueves, a fine stream

* Illustrations from photographs by the Author

of water heading among the highest peaks of the island. A letter to the leading storekeeper from a friend in Azua placed me in possession of a good bed in the rear of the store, with all facilities for satisfactory work, but after a few days' collecting about the village I decided that a camp nearer Mt. Tina, the highest charted peak in the West Indies and distant only fifteen miles or so, would be more productive of desirable birds.

The bird collector and his guide returning from a mountain trip in Santo Domingo

Arrangements were made with Señor Ramon Velasquez, a prominent resident who lived up the river several miles, and, saddling the mules, we moved up and located in the storeroom of the ranch. The ranch was built on a high bluff overlooking the river which here ran between mountains of considerable height. There were three or four other houses near by, but the clearings where tobacco and cane were grown, I learned later, were miles away.

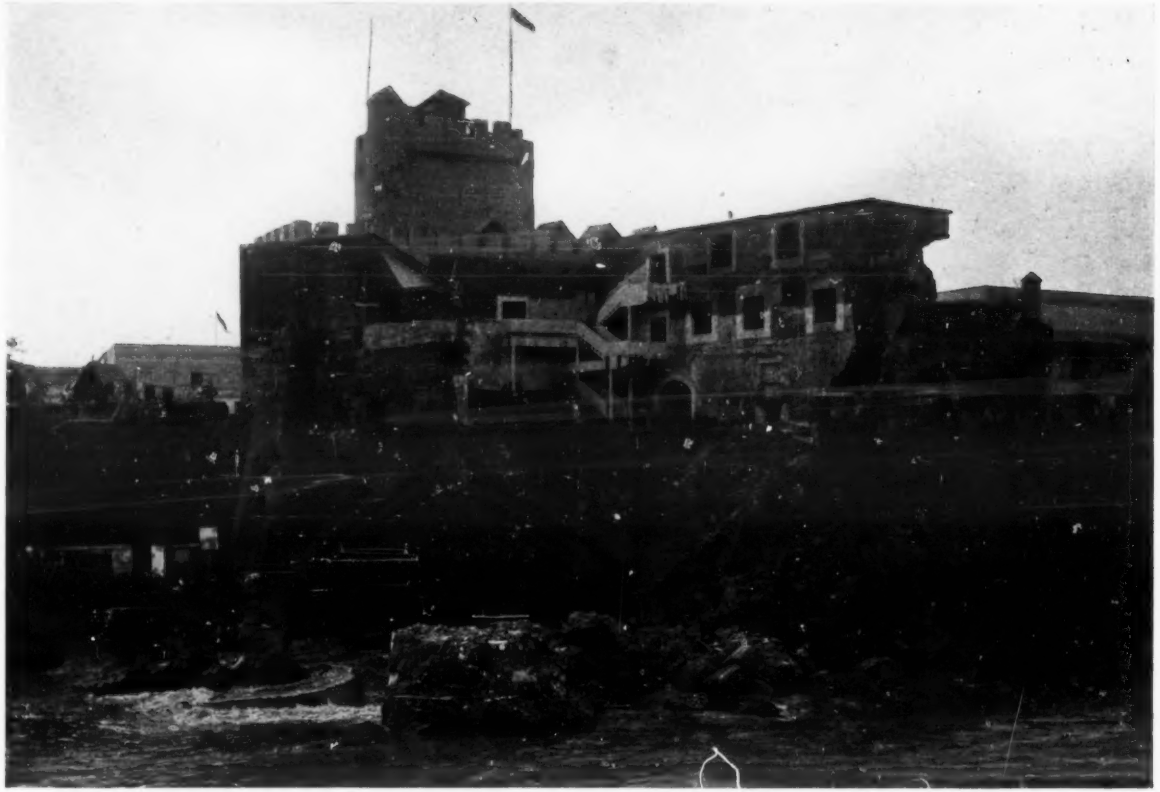
One of my first acts on reaching the settlement was to drop a red-tailed hawk which was swooping down toward a flock of chickens in the back yard. Judging by two or three experiences in Santo Domingo, I believe such wing shooting was unknown to the natives. Several red-tailed hawks lived near the settlement, and although they frequently caught fowls and were not wild, they were permitted to live on until my advent. One of them with a chicken in its crop I shot one evening, and another was taken care of when it lit near my camp in the cane field to watch an old hen and her brood.

Although my guide from Azua claimed to have done much hunting, his success

with the gun which I furnished was very negligible, but when he told me the reason of his inability to shoot a certain kind of pigeon that was occasionally seen in the underbrush near our camp at Mt. Tina, and which later proved to be a new variety, it surprised me so that I soon found it necessary to send the mules back to Azua in his care and depend on local guides in my further wanderings about the higher peaks of the island. As possibly some American shooter may be interested, I will give the reason for his nonsuccess with my gun. It was that the pigeon, when approached near enough to be in range, continued to walk away instead of standing perfectly still until the shot was fired! I later went over the ground this guide had hunted and secured several of the pigeons. The gun I used luckily did not require such an immovable target previous to the pulling of the trigger.

Mt. Tina lay at the head of a stream which entered the river close by the settlement, and Señor Velasquez a couple of days after my arrival agreed to pilot me to the top of it. We left one afternoon, following up the bed of the cañon to an old camp occasionally used by pig hunters. Two young men and four dogs accompanied us to hunt for wild pigs. When we reached the hut we found it occupied by two other pig hunters and their retinue of canine assistants. Shortly before reaching the camp, which was located on the creek bank at the lower end of a wide flat, we climbed up over a steep, rocky formation where a warm stream of water, bubbling out of the hillside a few yards away, kept a growth of green grass flourishing. From this we flushed a couple of killdeer uttering their characteristic notes as they flew out to meet us. They seemed to me decidedly out of place in the bottom of a narrow, heavily forested cañon, where beautiful trogans and strident-voiced parrots were the principal avian inhabitants. Here, as darkness fell, I

Mountain guides with outfit on slopes of Mt. Tina



FORT AT SANTO DOMINGO

The old fort built in the days of Columbus still houses troops

heard for the first time the clear, sweet notes of the hilgaro, a small bird that sings usually only at dusk or daylight. The natives consider this the finest songster in the island.

We started from camp early next morning and soon left the bottom of the cañon to begin a steep, zigzag course that, after luncheon, led us out on the ridge terminating at the peak of Mt. Tina. The last few hundred feet to the top was a stiff climb, and the Azua man, complaining of a tired feeling, was left in charge of the horses, while the Señor and myself went to the top. We found it to be an acre or so in extent, thickly covered with ferns and bushes and with no evidence of having been visited before. It dropped sharply away on all sides and afforded a fine viewpoint from which to locate other peaks in the range, but the height was disappointing to me, for several other peaks not far distant are some hundreds of feet higher. I regretted not having an aneroid barometer with me, but my work was originally planned for sea level conditions and the desirability of an instrument for measuring uncharted mountain heights was not thought of.

I have not yet learned who first proclaimed Mt. Tina to be more than ten thousand feet high, as it is marked on the charts, or whether some other peak might have been measured and Mt. Tina given the credit.

To one doing the measuring by climbing the mountain itself Mt. Tina affords easy approach on horseback, but to reach Mt. Pedro Blanco a few miles to the south, or Mt. Pelone some twenty or so miles to the north, both slightly higher than Mt. Tina, considerable foot work is required. One of the objects in visiting the highest part of the island was to search for nesting sites of an ocean bird, *Pterodroma jamaicensis*, one of the West Indian petrels, which formerly nested on Jamaica and Guadeloupe islands but apparently has now been exterminated on those islands by the introduced mongoose. No petrel burrows were found, but from the scattered pines of the mountain tops to the mangrove swamps of the sandy shores, wintering warblers from the Eastern States were always in evidence, the black and white and the redstart being two of the most common. It interested me greatly some months later to find on the summit of Cuba's highest peak, after a week's chopping and climbing to reach it, a black and white warbler sharing with a common island tody the distinction of being the only birds present at the time of my visit. On our return from Mt. Tina late at night, the pig hunters were found at camp, having been unable to follow their dogs through the tangled brush that the wary pigs frequented.

Señor Velasquez and his men returned to their homes next day, while the guide and myself spent several days at the camp collecting a number of species that found favorable living conditions in the deserted flat and the tall branching trees that dotted its surface.

There were several old, sour-orange trees scattered along for a mile near the trail through the flat, and these were particularly patronized by the parrots, for the seeds of the ripe oranges seemed to form one of the principal items of their food just then.

"Pericos," the local name for a smaller paroquet that was sometimes seen, did not appear to favor this part of the cañon, although a chattering flock used to sweep down through the royal palms in the cane fields about five miles below our camp, and later I obtained specimens down there. The handsome blue ground pigeon, living more like a quail or partridge than like our American pigeons, we sometimes caught sight of, or shot at in the shady parts of the forest, and it was here and with this species that my guide demonstrated his unfitness as a bird collector's assistant. When our provisions ran short we packed up and went down to the ranch house, the guide returning with the mules to Azua while

The Santo Domingo burro seems able to carry as large a load of charcoal as two men can pile on his back

Watching a boy in the warehouse at Sanchez shoveling over the drying cocoa beans reminded me of former years in California when I shoveled dried prunes in a similar manner in a San Jose warehouse

Tobacco for pipe smokers is wrapped in a palm leaf, tightly roped by a burly laborer, and left to dry for some time before shipment to market

In the vicinity of La Vega one strolls but a short distance along the river bank before encountering a busy washerwoman intent on her work

THE RIVER BANK AT SANTO DOMINGO IS A BUSY PLACE IN THE EARLY MORNING

CANOE LOADS OF FIREWOOD AWAITING PURCHASERS AT SANTO DOMINGO

I collected about the settlement, awaiting a fresh supply of rice, beans, bologna sausage, and coffee from Tubano.

The tobacco harvest was on at this time and the boys were routed from their slumbers at two o'clock in the morning to get a drink of coffee, mount their mules, and ride several miles up the river to the tobacco field, to return in the afternoon with the capacious saddlebags heaped with dried tobacco leaves. It was cold work, until sunrise at least, for I shivered under my two blankets as I watched the shivering boys saddle their mules, drink their coffee, and ride out of the yard into the windy, starlit trail. The tobacco was brought in, moistened with water and stripped by hand (a half dozen neighbors helping at this part of the labor), and then either rolled into cigars or wrapped up in a palm leaf to be tightly roped and pressed into a long, cylindrical roll for shipment to Santo Domingo. When the tobacco was gathered it was time to cut a part of the sugar cane, fifty acres of which were growing on a cleared hillside two miles up the cañon, so the family moved to the cane field and I shifted also to a shelter in the lower part of the field, spending several days collecting pigeons, numbers of which flew into the royal palms morning and evening to eat the ripening seeds; also blackbirds, which were more numerous here than elsewhere, paroquets, one compact flock being a daily visitor to the palms, as well as some of the smaller birds that the cleared land had an attraction for.

The cane was carried on the backs of burros to the crude press, was crushed by horse power between primitive rollers, and then boiled in an iron cauldron, one of the family standing by to keep the fire going and the scum cleared from the boiling juice. When boiled, the syrup was poured into clean, neatly sewn palm leaf molds which, when filled, weighed about a kilo each. This is the standard sugar of the villagers and finds ready sale in Tubano.

I wished to visit some of the higher peaks to the southward of Mt. Tina, so Señor Velasquez furnished me a good guide, and taking beans, corn meal, coffee, sugar, and a roll of bologna sausage sufficient for a five days' trip, we walked up the river some distance and then turned into a cañon that led toward the peaks.

We kept to the bottom of the cañon for hours until a solid wall of rock faced us, with water pouring over in a picturesque fall. We were compelled to retrace our steps to where an easier slope offered a chance to scale the southern side of the cañon. Slowly cutting a trail and holding to the tough bushes, we succeeded in reaching a ridge that stretched upward in the direction we were headed for.

We cut our way upward until nearly dark and then camped by a trickle of water not far from a ridge that would carry us straight up to our destination. On the morrow we started out in good shape and by eleven o'clock had arrived within a mile of the peak I desired to ascend.

The guide at this point refused to go farther. He insisted on turning down a cross ridge that led back toward the settlement miles away. My imperfect knowledge of Spanish prevented me from fathoming his reasons for not wanting to go higher, so I told him to wait a few hours for me and I would come back that way in the afternoon.

An indistinct pig trail up the mountain-side was thereafter my guide, but this led me in a roundabout way to the tops of several peaks with little valleys in between, where there were more North American birds singing and flying about than West Indian. A few of the little mountain sparrows, a hummer or two, and a flock of calling parrots could not compete in numbers with the many warblers flying back and forth from one pine tree to another. Soon after one o'clock a fog began to gather around the peaks and, finding no birds differing from those of the lower levels, I returned

Late in the afternoon the washerwomen of Sanchez stroll homeward

to my baggage and dropped down to where the guide was to await me.

I arrived at the spot and called. He answered from a mile away, across two dangerous looking cañons. As they did not seem absolutely impassable, I started across; by dint of careful climbing—at one place throwing the gun and bag across a grassy slide and holding on to the grass roots as I worked over, and getting out of one rockbound cañon by crawling up a long pine-tree root that with all its twisting could find no crack large enough to crawl into—reached the narrow, broken ridge down which the trail led. The guide pointed across a small valley to a fire burning on the mountain-side above it, and said we must reach that as the country below us was too rugged to work through.

We plunged down through ferns and bushes, and dodging rocks and boulders, crossed the valley and reached the top of the jagged ridge at last to find a long, easy trail stretching away below us.

At one point the fire, started by a pig hunter hours before, was burning over the ridge we ascended, and while for me it was a matter of stifling heat and holding my breath as we ran up across the burning area, for the shoeless guide it must have been still more interesting with hot rocks and burning sticks underfoot, as he stepped high and lively after me. Our way led down the crest of a long, fern- and pine-covered ridge to the thickly forested slopes below—my former camp at Mt. Tina—but it was long after dark when we reached the camp, for the guide failed to locate the right cross trail and we were forced to take a tortuous cow path that eventually landed us in the flat where the trail was known to both of us even in the darkness.

A couple of days at the flat and a couple more at the ranch finished the Mt. Tina region, and I returned to Tubano to hear a tale of woodpeckers on the slopes of Mt. Pelone about thirty miles to the northwest on the

At Bani many of the residents were shingling their roofs with a fresh covering of palm leaves

headwaters of the San Juan River. Woodpeckers were a desiderata, so a guide was hired and we started forth on a search for them. A day's ride into the mountains landed us at a friendly mountaineer's home, and here a second guide and his son were obtained to lead us into a region never visited by anyone other than the few mountain residents, who used the well watered valley lying at the base of Mt. Pelone to pasture a few cattle in the summer time. Reaching this valley late one afternoon, we found a little open hut and a well built corral where the cattle were held overnight before starting out on the return journey to the settlement. Immediately on our arrival the boy started out to round up a couple of cows with small calves. The calves were corralled and we had fresh milk for coffee every morning during our stay.

The cold water and frosty mornings of this mountain valley were very invigorating after my months of coast living in the tropics. If some kindly disposed sportsman would plant a few trout from the United States in the headwaters of the San Juan River, this region would furnish an excellent recreation ground for lowland dwellers who desired a change of climate at little cost.

Wild pigs range in all the cañons but the pigeons and doves of several species are found more common at a lower altitude. The most interesting birds to me, after thorough search failed to reveal signs of the mythical woodpeckers, were the crossbills, typical boreal birds which somehow had become residents of this tropical isle. Their presence on the island had been discovered but a few months before by Doctor Abbott, an old Smithsonian collector, of whom I used to read years ago in short museum papers as discoverer of new species on various East Indian islands. I met him in Sanchez as he was leaving for Washington and he told me the rainfall of the interior of Santo Domingo would equal

that of any East Indian land he had visited. Fortunately for me the rainy season was over when I reached the highlands of the island and only a desultory shower or two were encountered during my entire stay.

The crossbills, as a rule, kept to the high pine ridges and much climbing was necessary to reach their haunts, but a flock of crows that also frequented the region were more friendly and often flew down to light on the corral fence but a few yards away from us.

I climbed to the top of Mt. Pelone one day and left a small monument on the highest point as a record of my visit. On the rocky slope below me a forest fire was crawling slowly upward, and the next day from a distant ridge I saw it sweeping over the barren dome of the mountain. Fire-setting seems to be a favorite pastime of the mountaineers and, while it may help the pasture and reduce the wild pigs' refuges, it is bound, by the destruction of so much vegetation on the steep mountain-sides, to cause greater floods along the lowland river banks when the rainy season is at its height. Although the woodpeckers proved non-existent, I was well satisfied with the week's stay at Mt. Pelone and returned to Tubano with a good series of Dominican birds.

The patriarchal schoolmaster of the village came in the first night of our return to enthuse over the success of the trip, and I still have at home a congratulatory letter he wrote to me at Señor Velasquez's ranch after our ascent of Mt. Tina, in which he characterizes, in rich Castilian phrases, the climb as the first successful attempt by a foreigner to scale the highest peaks of the island since the day that Columbus first sighted them in 1492. To his beneficent interest in my work I attribute much of the success of the trip, for without it the question of guides would have been much more serious.

After packing the birds for mule-back transportation, I left Tubano one morning with a pack train bound for Azua and with a much higher regard for the mountain inhabitants of the Dominican Republic than I had expected to have on my entrance to their fastnesses.

From Azua I elected to travel overland to Santo Domingo instead of waiting for a steamer, so, arranging for transportation of specimens and outfit, I hired a boy and mules and sallied forth. At Bani an auto-stage became the means of transportation, and rough though the road was, it surpassed the slow travel of the ancient mules except at river crossings where ox teams became the motive power. It was roofing week in Bani seemingly, and most of the residents of the town were replacing their house coverings with a fresh coating of leaves. Bani is quite a shipping point for coffee and several yards of drying coffee were seen as we entered the town.

As Santo Domingo was neared, cleared fields and cultivated plantations became more common, and the last few miles over an excellent motor road gave one a feeling of pleasant anticipation for the change to city living. A few days in Santo Domingo City suffices one, and the next steamer for the Haitian coast saw me aboard as a passenger for Aux Cayes to outfit for a trip to the higher parts of the La Hotte Mountains in southern Haiti.

JACKASS PENGUINS AT HOME

The so-called jackass penguins of southern South America and South Africa do not incubate their eggs upon ice as some other species are obliged to do, but enjoy the shelter of a burrow a few feet deep. They are now seen in the bottom of their home after being dug out by the inquisitive photographer

DAYS WITH THE BIRDS OF TIERRA DEL FUEGO*

BY

F. E. BLAAUW, C.M.Z.S.

Last June the American Museum was visited by the author of this article, who is one of the best known of living aviculturists. On his estate at Gooilust, between Amsterdam and Utrecht, Holland, he has a park 140 acres in extent, devoted to the rearing of exotic mammals and birds. As far back as 1889 one may read in the *Bulletin de la Société Nationale d'Acclimatation* an account by Mr. Blaauw of the collection of living animals and birds at Gooilust, and for many years he has kept white-tailed gnus, American bison, blesbok, banteng (or Malayan ox) eland, Przewalski's horses, and kangaroos.

Among the birds his favorites are the waterfowl, and the ornithological and avicultural journals of France, Holland, and England contain many an entertaining account from his pen of the habits and nesting of the rare species of birds that he has kept and bred. In 1897 Mr. Blaauw published a *Monograph of the Cranes*, beautifully illustrated from paintings of live specimens in the Zoological Garden of Amsterdam, which constitutes an authoritative review of this family of birds.

Wishing to see more of South American waterfowl in the wild state, he undertook in 1911 a journey across the southern part of that continent to Chile and south to Tierra del Fuego. It is of his visit to this remote Land of Fire that we are fortunate to read in the following account. Three years later he paid a visit to South Africa, observing both the wild birds and the farming of ostriches.

Like all nature lovers at the present time Mr. Blaauw is deeply concerned over the gloomy prospect confronting the wild creatures of even the most remote lands. In the letter to President Osborn which accompanied this manuscript he called attention to a few of the most glaring instances of slaughter. "In Zululand, following the advice of some professor or other, they are waging a great war against all the wonderful game of that country, under the delusion that this will also exterminate the tsetse fly. Just as if the fly won't find other animals to live on! In the Addo Bush near Port Elizabeth they have almost exterminated the last South African elephants to please the greed of the surrounding land owners, who want the reserve notwithstanding the fact that thousands of acres are not being used elsewhere.

"I fondly hope," he writes, "that my paper will not send people with guns to Tierra del Fuego to kill and destroy what I have loved to watch. So if you think that it may have this effect, please burn it instead of printing it."—THE EDITOR.

IT WAS in April of 1911 that I visited Punta Arenas in the Strait of Magellan, with the object of crossing over to see something of Tierra del Fuego, that land of wonders which I knew only from Darwin's description in the *Voyage of the Beagle*. Although this great island is so near Punta Arenas, I found it extremely difficult to get any useful information concerning the country, and it required a couple of days to complete my preparations so that I could cross the strait.

When at last I was ready to start, I left the bulk of my luggage in the care of a hotel keeper at Punta Arenas, confiding to him also a pair of live, long-billed parrakeets which I had brought from Osorno. Taking only a valise, I proceeded to the boat, which was to leave at half past three that afternoon. The little steamer was of the worst possible description, and looked as though the least bit of bad weather would prove its undoing.

At the last moment, just as we were about to cast off, a peon arrived with two saddle horses, expecting to board the vessel. The captain, a young Norseman who spoke English, refused to submit to such a delay, saying it was too late to load the horses, and off we went, leaving the poor man on the pier!

All about the harbor, on every buoy or empty boat, were numbers of white-breasted cormorants (*Phalacrocorax albiventer*), and as we proceeded we saw many penguins (*Spheniscus magellanicus*) swimming in the sea. The latter navigate in long strings, one behind the other, and I counted as many as forty-nine in such a file. They would swim unconcernedly until quite near the vessel and then suddenly take fright and dive. They would reappear at a short distance, but their fear would cause them

*Illustrations from copyrighted photographs by Rollo H. Beck

General view of the town of Punta Arenas, from which the author started on his trip to Tierra del Fuego

Waves at high tide along the water front at Punta Arenas

to dive again with a jerk, and this would be repeated until they were far away. On one occasion as the ship crossed their course they were so near that they dived right under the keel, reappearing on the other side. Their behavior gave one the impression that they saw the ship or realized what it was only when quite close. They were most entertaining to watch, and I saw them during nearly the whole trip across the strait. There were also plenty of black-backed gulls and terns about.

We were apparently midway between Punta Arenas and Tierra del Fuego when I asked the captain at what time we were to land.

"Oh, sir, we will probably not land at all tonight," was his unexpected answer. "I cross for the first time, and the entrance of Porvenir is very difficult; so if there is a fog, I dare not risk it."

"But in that case where am I to spend the night?" I inquired.

"Oh, you will have to spend the night, sir, on the sofa in the saloon."

As he said this a cold shudder ran down my back. The "sofa" was the dirtiest bench imaginable, and the saloon a low, stuffy compartment full of evil smelling half-castes.

"But," continued the captain, "if there is no fog, and the moon comes out, I'll venture it."

Heartily did I pray that the moon would come out; and when we were close to the land, my trust was rewarded. So my friend the captain said he would attempt to enter the harbor. "I am glad for your sake," was his good-natured remark. "It would not have been comfortable for you to spend the night on that sofa."

As we neared the land, there was no vestige of any habitation or entrance, and I began to wonder where Porvenir could be; the boat approached still closer, and then I saw a side entrance of the sea into the land. Thither we steered under a glorious moon, and I began to realize that the captain had not exaggerated in saying that the entrance was difficult. We were obliged to follow a zigzag course, to double three or four corners, and to avoid, so I was told, numerous sand bars, before the lights of Porvenir became visible in the distance, at the end of a deep bay. Near the last turn there was a wide sand bank, and on it a large flock of upland geese (*Chloëphaga dispar*) were quietly watching us pass. A little farther on a pair of steamer ducks fluttered away from our vessel.

At length we tied up at a pier a good distance from the lights of the "town"; and there being no one to help me with my valise, the captain kindly detailed a seaman to carry it for me. This sailor seized my bag and ran off into the darkness. My shouting brought him back. "Where are you going, my friend?" I said. "I believe I told you I wanted to go to the inn."

"Well, sir, I was never here before," he answered.

"I don't doubt it," said I, "but you surely must suspect that the houses are where we see the lights." So telling the man to follow me, I steered through the obscurity toward the town, hoping to find the inn called the "Hôtel Alleman." Eventually I succeeded; the hostess, who was a German, asked me whether I wanted a first- or a second-class accommodation. Upon my demanding her best first-class room she showed me into a small one at the end of a long passage. It contained a bed and a washstand, but nothing else. The room, however, looked clean, so I pronounced myself satisfied, and begged her to prepare dinner. This she promised.

In the meantime her husband, an Englishman, had come in. I told him I wished to go on to Jente Grande the next day. "Then you had better telephone." What a welcome and unexpected answer! "You can do that at a shop close by."

So to the store I went, and by telephone received a most courteous answer from the Jente Grande Company, with

JACKASS PENGUINS ON BLEAKER ISLAND, FALKLANDS

The penguins seen by the author in the Strait of Magellan also breed on the Falklands, congregating in considerable numbers. We can easily forgive the good old near-sighted saint of Anatole France's *Penguin Island*, who mistook the birds for men and proceeded to evangelize them. But here the naturalist pauses to reflect that the "pingouin" of the original really means an auk, and the translator has taken a decided ornithological liberty

GULLS RESTING IN A QUIET COVE IN THE FALKLANDS

Near the gulls stands a night heron very similar to that which haunts our northern ponds at dusk. These two familiar types of birds seem in strong contrast to the penguin a little farther back

What's in a name? The steamer ducks were so called after a noisy, old-fashioned side-wheeler, rather than the stolid freighters which here serve them as a background. Perhaps we can call them namesakes, nevertheless

the offer of a saddle horse, and for my luggage the use of a cart which took goods to their place from the steamer. The favor was gladly accepted, and I went back to my inn, hoping for dinner.

In a clean-looking room was a well-set table—even flowers were not lacking. The apartment, however, was icy cold, while a big stove stood there fireless but apparently quite ready to light. When requested to start the fire, my host replied that the stove would give no warmth, only smoke; I asked him nevertheless to try, and in ten minutes volumes of smoke filled the room.

Now I happened to be well acquainted with this kind of stove, and I soon put things right, so that a genial heat replaced the choking fumes. My host was very much astonished, but . . . fuel is scarce in some parts of Tierra del Fuego.

Next I asked for my dinner. This was no easier to get than the heat, and consisted of one egg, a slice of meat, and a little bread. Say what I would, nothing else was to be had. So I went to bed rather hungry, enjoining my hostess to get me something more for the next morning.

This she did, and after breakfast I went out to enjoy the beautiful views about Porvenir, the capital of Chilian Tierra del Fuego. This settlement lies at the end of the deep bay, which looks more or less like a lake, and is surrounded by rising ground. Around the bay were large flocks of upland geese, upon its waters some pairs of steamer ducks, and flying about were several pairs of crested[1] ducks (*Anas cristata*) which often came quite near.

The males of these last birds seemed a little larger than the females, and showed more white in the wing; they were very pretty and quite tame. The bay, I afterward heard, was a sanctuary where no birds could be shot.

The steamer ducks in the bay were of

[1] "Crested duck" is the oldest name for *Anas cristata*. It was used by Latham. Unfortunately Sclater and Hudson use "crested duck" for a bird of another genus, *Sarkidiornis*. Crawshay, in *Birds of Tierra del Fuego*, calls *Anas cristata* the "Antarctic duck." This name is not very appropriate, because the bird ranges north to Peru and is not found in the true Antarctic regions.

the small, "flying" species, and they also went in pairs. I may as well give my opinion concerning these birds and tell of my experiences at the same time. It is a subject of controversy among ornithologists whether there are one or two species of steamer ducks. In my belief there cannot be the slightest doubt that there are two species. Much has been said and written on this subject, but the differences between the two species have seldom been properly appreciated.

The typical *Tachyeres cinereus*, the steamer duck of seafarers, is a big, heavy bird quite unable to fly, not only when old, but even less able when just attaining maturity. These birds cannot even rise above the water, but when alarmed make off by striking the water with their wings, so that a great splashing ensues. They are absolutely confined to large bodies of salt water; and I have seen great numbers of them in Smith Channel, in Eden Harbor, Indian Reach, —as many as forty-two together. These flocks consisted of pairs of old birds with full-grown young of the year.

In this species both sexes are gray; the male has a pale or pearl-gray head and neck, and a bright yellow bill. In the female the gray is duller, so that the head is not strikingly paler than the rest of the body. The bill is also yellow, but not so clear in color. In the young birds seen by me in Smith Channel, and later on at Melinka near the northernmost island of the Chonos Archipelago, the plumage is tinged in some parts with brownish gray, but not enough to obscure the generally gray aspect. The bill-color of such young birds is mixed with a dark greenish tint, and their legs are dark.

These birds were evidently young of the year, since they were under the guidance of a pair of adults. This was readily observed at Melinka, where they were tame. Yet they looked even heavier and clumsier than the adults, and most certainly could not fly. They were expert divers.

Closer view of two steamer ducks resting on the rocks.—The differences between flying and nonflying birds are not evident in a photograph; indeed, some of our most competent authorities on ducks are not yet converted to the view that they are of specific importance

The second, or flying species, is quite a different bird. To begin with, both sexes are much smaller than in *Tachyeres cinereus*, and the female is still smaller than the male. She is also very differently colored. The male is clear gray with a white breast and a clear yellow bill. His tail is elongated, and its point carried upright when swimming. The female has a brown head, and the rest of the body is of a beautiful vinaceous color, with a white breast. The bill is brown. The white speculum in the wing is present in both species.

On the seashore near Jente Grande I saw small flocks of these flying steamer ducks, and a good many pairs on the lagoons inland. I watched them repeatedly flying high overhead, and at the sea coast I noted that they went from the inland lakes toward the shore, and vice versa. Not a single bird of the nonflying species was observed by me in this part of Tierra del Fuego.

My kind hosts at Jente Grande, who aided me in these researches, were quite convinced of the validity of the two species, as was also Mr. Cameron, the director of the Jente Grande Company. The smaller kind is found a good deal inland, they told me, but the large one is restricted entirely to the sea. This quite agrees with my own observations.

In the lagoons about Jente Grande the birds were very tame, and when I rode around a pond or stood at the edge of the water, pairs of small steamer ducks would come near to look at me. When alarmed they sometimes start off without getting quite clear of the water, then they rise above it but still touch with the points of the wings as they fly away. This is nevertheless quite a different mode of progression from that of *Tachyeres cinereus*, and resembles the way a coot sometimes starts away. The larger steamer duck does not succeed in raising its heavy body out of the water, but strikes right into it with both wings, and makes a great splashing.

Of the small flying species of steamer duck (for which the name *Tachyeres patachonicus* has been proposed) there are a female and a young male (both from the Falklands) in the Leyden Museum, several females in the British Museum, and an adult pair in the Buenos Aires Museum.

Let us return now to the fine clear day when I was admiring Porvenir Bay. In a farmhouse on the far side I caught signs of movement; a small wagon was taken out and a pair of horses harnessed to it; then a white saddle horse was brought forward. Half an hour later the wagon was seen advancing in my direction and a man mounted the white horse. This seemed not so easy, for the animal resented it very much. With the man on its back, the horse advanced by jerks and starts, with nose in the air, and after a while both wagon and rider were at my door. The man descended, my valise was placed in the vehicle, and I mounted the white horse.

The wagon was to show me the way; this was easy, and I followed at some distance. We first ascended the hills behind Porvenir, and then reached some undulating ground grown over with short grass and low bushes but quite without trees. Soon we were passing along a little piece of water where many upland geese were running about, feeding on the short grass; they let us go by without their being disturbed in the least. Climbing still higher, I now enjoyed a good view of the country, most beautiful in its wild loneliness, its undulating surface apparently without end, short grass and low bushes stretching away until everything was lost in the purple of the horizon.

Several lagoons were passed, some large and of intricate shape, with deep bays, high promontories, and outstanding islets. Others were round, with smooth margins like an ornamental lake in a park of old Europe,—or sometimes only a part was thus rounded, the rest running on to more irregular shape, full of bends and corners.

In one section of a large lagoon were great numbers of coscoroba swans, and as I approached, they challenged me with their call of "coscoroba." In the different museums I visited in South America I found only fairly large cygnets of *Coscoroba candida*, which had lost the markings of the newly hatched young, and were now yellowish gray. I am therefore very much pleased to be able to figure, through the kindness of the Duchess of Bedford, the newly-hatched young of the species, bred at Woburn, England.

The so-called coscoroba swan I have always regarded as a gigantic tree duck, and the character of the head markings found on the downy young at this age go far to prove that I was more or less correct in my surmise. In fact these markings as shown in the figure combine those of the duckling of a shelduck with those of a tree duck. The head markings show to a great extent the characteristics of those of a young tree duck, while the pattern on the body is very like that found in the downy young of a shelduck.

About the same body of water thousands of upland geese were running everywhere, and a good many crested ducks were along its margin and in the lake. All these birds were so tame that I could get quite near them. After admiring them for a while I rode on, and having passed over some higher ground, came to another piece of water, or perhaps another arm of the same lagoon.

There a great number of black-necked swans (*Cygnus melanocoryphus*) greeted my view. It was a beautiful sight; there were some little islands and everywhere black-necked swans, with only an occasional coscoroba among them. Probably these two species do not mix readily, but they were both equally tame, and I could ride down to the margin of the lake without their taking wing. On the little islands, I afterward heard, black-faced ibises (*Theristicus melanopsis*) breed.

Leaving the black-necked swans I rode on after my guide and passed flock upon flock of upland or black-banded geese (*Chloëphaga dispar*). This goose is often called the Chilean form of *Chloëphaga magellanica;* but the expression is misleading, for although Tierra del Fuego belongs for the greater part to Chile, *C. dispar* was not found by me in Chile proper. I have been over a good part of southern Chile, but I have never seen a single specimen, nor even heard of it.

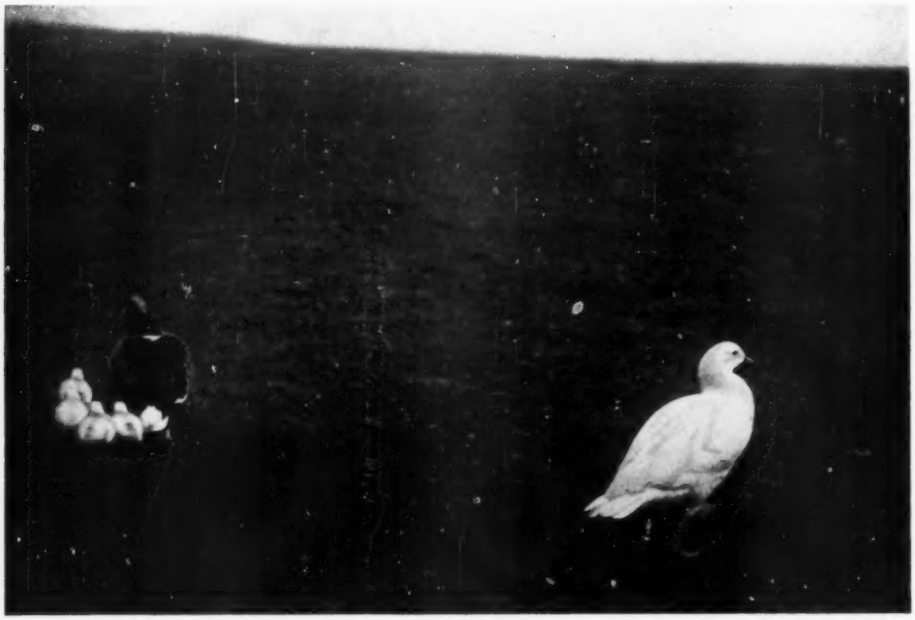
On the other hand it inhabits Tierra del Fuego in countless numbers as a resident, and would probably be still more numerous were it not so much persecuted. One meets it almost everywhere, and it seems to be especially attracted by the fine grass which results from the grazing of sheep. In spite of its being a resident in Tierra del Fuego its life history is not completely known; for example, several people told me it had never been found molting. Indeed, the common belief was that it did not

Coscoroba cygnet two weeks old, sketched by the author. The peculiar color pattern indicates that in spite of its large size it is probably more closely related to the shelducks and tree ducks than to the typical swans. The ground color is white, the markings are dark gray, bill and feet flesh color

molt like other geese. Now it is quite certain that *Chloëphaga dispar* molts its flight feathers all at the same time like nearly every other goose. There is really only one exception to this rule, *Anseranas melanoleuca*, the Australian pied goose, which molts like a hen, and can always fly. So it only proves that at the critical time of the molt the birds wander away to some unknown part of Tierra del Fuego, or to some of the adjacent islands, where they can renew their pinions in peace and security. This circumstance is probably all that keeps the species from destruction, inasmuch as it would certainly be exterminated if it molted in the inhabited country, and meanwhile lost the power of flight.

Among all the flocks of *Chloëphaga dispar* I have seen only very few white-breasted birds belonging to the allied *C. magellanica* of the Falklands. They had probably lost their way and joined flocks of *C. dispar*. Nor have I ever met any considerable number of *C. magellanica* together.

At last after a three hours' ride from Porvenir, I saw a deep bay formed by the sea, and not far from it some houses, painted yellow with scarlet roofs. The bay is the "Jente Grande" and the houses constitute the settlement of the same name, where I was going to spend a few days. I was welcomed with the greatest kindness by the director of the Jente Grande Company, and at luncheon made the acquaintance of his whole household.



Kelp goose (a near relative of the upland goose) and her family.—The female shows a considerable degree of protective resemblance to her surroundings, yet the young are less fortunate in this respect. As for her consort, unless nature designed him to lure enemies away from the brood, we cannot guess why he was made so conspicuous

Two thousand sheep were to be shipped that afternoon. They are loaded by driving them in small parties on to a narrow bridge that ends on the vessel. At the end of the gangway that rests on the ship the hurdles along its sides are so close together that but one sheep can pass at a time. In this way it is possible

to count the sheep and to get them into the spaces prepared for them, which hold six sheep each. The difficulty is to get one or more sheep to set foot on the gangplank, but this achieved, the others follow in the proverbial way, so that a continuous stream of sheep flows into the ship. These poor creatures were to be taken across the strait to Rio Secco, where all were to be slaughtered the next morning.

On the morrow I was again in the saddle, and under the kind guidance of Mr. Aylwin set out to see as much as possible of the birds around Jente Grande. The first ones seen that day were large flocks of ruddy-headed geese (*Chloëphaga rubidiceps*) or "brent" as they were called there. These geese were grazing not a hundred yards from the house, and only took wing after I came quite near, alighting again a hundred yards farther on. Unlike the upland geese (*C. dispar*), these are only summer visitors to Tierra del Fuego. At the time of my visit in the beginning of April they had gathered into flocks previous to their departure, which would take place probably in a few days.

I was told that still another member of the genus *Chloëphaga poliocephala*, a scarce breeder and summer visitant in this country, sometimes associates with the ruddy-headed geese in these flocks, but personally I did not see a single example of this goose in Fireland.

Proceeding on our ride we came to a large but apparently very shallow lagoon, with flat margins. Some of these bodies of water are fresh, others are salty. On this one I found five flamingos (*Phoenicopterus chilensis*), which my guide told me came to the Jente Grande lagoons in autumn to spend the winter. They were rather shy and flew off as we came near. While I was standing at the water's edge looking at the flamingos, a pair of large ducks came flying overhead, and landed or, better, alighted in the water with a splash not far from where I stood. They proved to be the flying steamer ducks mentioned before. Riding along the shore, I observed five more pairs of these ducks; when I stood still they all came quite near, so I could see them well. All were of the same kind, the males light gray, larger, and with bright yellow bills, the females vinaceous, and with brown bills. This was a fine sight!

In the same lagoon in the shallow water stood numbers of upland geese, while a good many crested ducks were swimming about. One large red-necked grebe (*Æchmophorus major*) was also seen.

Leaving the lake, we came into some hilly country, and in a small valley where the bushes had attained slightly greater dimensions were two old carancho nests. These were built of sticks right from the bottom of the bush, filling it entirely and reaching a height of five or six feet. The carancho or carrion hawk (*Polyborus tharus*) is a large bird of prey, with more or less vulturine habits, very characteristic of southern South America.

Sitting on the ground as though sunning themselves, were two big eared owls looking like cats, and fairly tame. In the same neighborhood a beautiful gray hawk, probably *Buteo erythronotus*, with white tail tipped with black, flew over the ground; and I also met the cinnamon kestrel (*Tinnunculus cinnamomeus*). The chimangos (*Milvago chimango*), likewise large birds of prey of versatile habit, were not very numerous. In a tall shrub there perched a flock of black starlings (*Curaeus aterrimus*) singing lustily in their peculiar busy way.

That afternoon I went out on foot alone to see something of the sea birds along the Jente Grande Bay. Between the house and the bay were some low meadows with water holes in them. In the dampest places grew great masses of a succulent plant, extraordinary in appearance, of most vivid scarlet and carmine shades, but reaching only to the height of a few inches.

A Fuegian Indian couple in camp. It is easy to believe that a race accustomed to a rude out-door life in this inclement region is scarcely fitted to combat the insidious dangers of a more comfortable existence

Following the shore line I came to a projection of stones and pebbles on which were great numbers of the white-breasted cormorant (*Phalacrocorax albiventer*), as well as some small gray gulls (*Larus glaucodes*), with black hoods and orange-yellow bills, and some oyster catchers (*Hæmatopus leucopus*). Then rounding a promontory I came upon a number of lesser steamer ducks, several of which flew away as I approached. These were all of one species, and a lone pair of crested ducks was near them.

The next day I was to go to Philips Bay, where there is a station of the Explotadores Company; and I was to lunch half way at the second farm of the Jente Grande Company. It was a glorious morning, but with a driving, icy-cold wind. The road at first led along the eastern shore of Jente Grande Bay, after which I turned inland amid lovely scenery. The country here was hilly, wild, and grand in its desolation. On an eminence to my right a guanaco stood out clear against the sky, watching me intently. Never before had I appreciated the wild, elegant beauty of the guanaco. The rich rufous color of his coat and the black of his head harmonized to perfection with the ruddy grass of the hills. After looking at me for a while he cantered away at a fine springy gait. On I rode, and after a time, turning around, I saw him again watching me alertly as before.

Everywhere were flocks of upland geese. A little later I sighted another guanaco, and toward noon I saw the sea from the top of a hill on my way, but then the road carried me more to the landward. Passing a small stream, I encountered a flock of a couple of thousand sheep being driven to Philips Bay,

under the guidance of two mounted peons and some dogs. Farther on by the bank of another small stream I saw a brown pintail duck (*Dafila spinicauda*) squatting motionless, allowing me to pass in the hope of remaining unobserved. Nor did I wish to undeceive it.

One more turn between some hills, and the Jente Grande farm, Estancia Sarita, lay before me. It was reached in a few minutes. Near the manager's house I alighted, and my horse, wet as it was from the exertions of the ride, was simply tethered to a post in spite of the driving wind.

At the house I had lunch and was taken after that to a small stream in a hollow where ducks usually abounded. I was "in luck" for the ducks were there, and I could admire, as they swam in a small pool, the Chiloe widgeon (*Mareca sibilatrix*), yellow-billed teal (*Nettion flavirostre*), gray teal (*Querquedula versicolor*), brown pintail (*Dafila spinicauda*), and red shoveler (*Spatula platalea*), the last of which had not yet been recorded from Tierra del Fuego. The only ones to take wing at our intrusion were the widgeons; the others were exceedingly tame, taking no more notice of us than my own captive ducks of these species at home in Holland. No one was allowed to disturb the birds, said the manager, and they became tame accordingly.

After inspecting the ducks I saw a few tame Indians. They served as peons, and I was sorry to hear that these poor creatures do not stand civilized life, even in a low stage. Clothes and houses cause them to contract tuberculosis; the children succumb first, then the adults.

About half past one we again mounted our horses to proceed to Philips Bay.

Fuegian squaw in her canoe. South America has provided the African native with his domestic duck, and primitive man, even in Tierra del Fuego, it appears from this picture, has adopted the domestic cat, an animal of largely African descent

A SUMMER VIEW OF SOUTHERN TIERRA DEL FUEGO

This picture reminds us in no small degree of Alaska. The similarity does not of course extend to the fauna, and the only birds showing a close relationship to the northern representatives are those belonging to cosmopolitan groups such as the gulls and terns

DOMINICAN GULLS ENCIRCLING A "FRIGORIFICA"

These gulls, which replace ecologically the vultures of warmer climates, are here shown about a meat-packing establishment to which they have been attracted by the presence of offal

The country to the east of Estancia Sarita was at first quite flat. In little pools I saw more gray and yellow-billed teal, as well as some coots, and in the grass countless flocks of upland geese. Next we passed over some beautiful, wild, hilly country, and in front of us lay a large plain as flat as a billiard table, with the sea to the north and hills to the east. Coarse rufous grass growing in patches covered the plain, and a great many cows and horses were feeding upon it.

As we rode on, some buildings came into view. They were those of the Philips Bay station of the Explotadores Company, which holds the greater part of Chilean Fireland. Close to the sea stood the largest building, the so-called "grasserie," where every year thousands of sheep are slaughtered for the preparation of tallow.

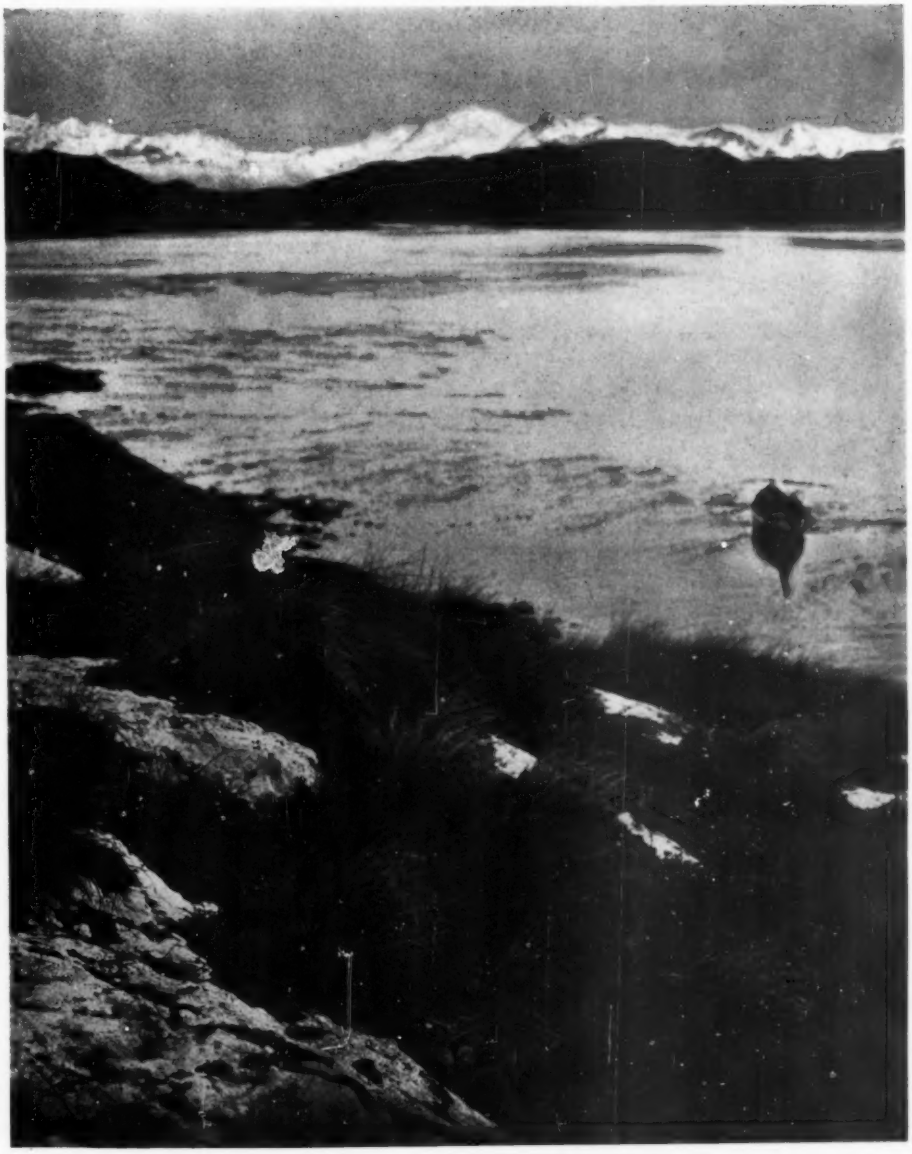
This ghastly establishment was shown me by the manager, but the only things I found at all attractive were the thousands of sea birds, which fed on the blood and refuse that had run from the factory into the sea. Among them were countless gulls (*Larus dominicanus*), many crested ducks, oyster catchers, little plovers, and occasionally other birds. After seeing the birds I was taken to the manager's house, situated in the midst of this wild country, grand in its monotony.

The following morning I took a walk into the hills, and coming to a part where some low bushes grew, I saw a small bird fluttering helplessly in front of me unable to fly. A short run and I had caught it, a very beautiful sparrow-like creature, yellow, gray, and black, with gleaming black eyes. It uttered a low, continuous, rattling sound as I took it up. Apparently it had flown against a telephone wire and hurt its wing. This was a male of the finch known as *Phrygilus princetonianus*. The species is a representative of the Lapland bunting (or longspur) in the southern hemisphere. Its habits, style of song, its form, and hind toe with long claw all point to this, and the bird is really not a *Phrygilus* at all, though usually so called.

I took it back to the house, and my host procured a small cage in which to put the poor little bird. It was very thin and feeble, and after having drunk, it took a sound sleep. After that it began to feed on canary seed, and I ultimately succeeded in bringing it home in good health. Later on, during the homeward voyage, as the weather grew warmer, this bird, quite tame, came into full voice. Its charming song, in style much like the continuous one of the Lapland bunting, and very sweet, began on shipboard every morning as soon as the day broke.

After my host had helped me care for my bird, he told me that he had another surprise for me in the form of a living seed snipe (*Attagis malouinus*), which had also damaged its wing against a telephone wire near the house. This was brought forth, and I could now admire a living example of this curious grouselike bird at close range. Unfortunately its wing was so badly broken that I could not venture to add it to my traveling menagerie. So it was decided to put the bird out of its misery. My host told me that the seed snipe bred inland in wild, desolate country, laying only four eggs.

In the great plain mentioned above which I passed in going to Philips Bay, there are still some guanacos, living peacefully with the cattle. The adult animals are not killed, but the young that they bear are at once secured for the sake of their skins. In snowy winters, moreover, many guanacos die of starvation throughout the sheep districts. Before the sheep were so numerous the guanacos could live on the long grass which stuck out of the snow, but now that this grass is entirely eaten by the sheep, there is nothing for their wild competitors to live on, if the snow lies thick for any length of time. This fact, and the destruction of their young, must



SEASHORE VIEW AMONG THE ISLANDS OF SOUTHERN CHILE

The rowboat is traversing a patch of great brown seaweed; the bleak shore supports little vegetation other than tussocks of coarse grass. For the birds, however, isolation spells safety, and most of the waterfowl have little need of more luxuriant plant life on land

very soon put an end to the existence of the guanaco; I deem it a great pity that some means are not adopted by the settlers for its preservation.

In the afternoon of my second day at Philips Bay I was to leave Tierra del Fuego, where I had spent such a delightful time. A boat was to take me across the strait to Rio Secco on the mainland, with a cargo of live sheep. Because of the low water, the boat could not land near the Philips Bay station, so I had to drive out to the place of its anchorage, five or six miles away. The best road to take went along the shore, and I passed again near where the many birds were feeding on the blood of the sheep. A small flock of nine guanacos was also admired on the way.

At different places along the shore I saw great tangles of giant sea weed, colored brown; also some kinds that were green, and others carmine red. We reached our boat in good time, and after taking leave of my kind host, I went aboard with my luggage and my bird.

At ten o'clock that same night we arrived at Rio Secco on the other side of the strait, but I passed the night on board, and breakfasted next morning at the house of the manager of the Refrigeratores Company. He showed me what became of the sheep which had come over with us. These were all animals of the first quality; they were slaughtered and their carcasses frozen for shipment to England.

The manager had some business in Punta Arenas, so about eleven o'clock he kindly offered to take me with him, and after an hour's drive which took us continually through the remains of burnt forest, I was back again at the Kosmos Hotel in Punta Arenas. There I found the luggage I had left, and my two long-billed parrakeets, which were still in good health.

Sunrise in Beagle Channel, along the cold, forbidding coast of Tierra del Fuego. But if you would see the waterfowl, go rather to the earth's remote, desolate fastnesses than to wooded shores on the equator where lurk so many of the deadliest enemies of birds

Type of truck that will be used on the Mongolian Plateau and the Gobi Desert

THE MOTOR TRUCK IN CENTRAL ASIA

BY

ROY CHAPMAN ANDREWS*

WITHIN the last few years it has been found that automobiles can be operated successfully on the grasslands of Inner and Outer Mongolia and the rolling surface of the Gobi Desert. Motoring on the Gobi is not quite like rolling down Fifth Avenue. If anything happens to your car there are no garages just around the corner—in fact, there are no corners! You must be prepared to remedy any difficulties yourself, for to be alone on the desert when something is wrong with the digestion of your automobile can have its serious aspects. If you are on the main caravan trail it may mean a walk of only forty or fifty miles to the nearest well, where you will perhaps spend days of waiting until help arrives from Kalgan or Urga—unless you are an expert mechanic and have an assortment of spare parts. But if you happen to be running across one of the vast areas which separate the caravan trails and your car goes wrong, help is out of the question; you must depend upon your own resources.

I remember once when we were returning to Kalgan from Urga, the capital of Mongolia, we discovered that the oil of our motor had all leaked out of the cans. It was impossible to go much farther and we were debating what to do. As our car swung over the summit of a rise, we saw the white tent and grazing camels of an enormous caravan. Of course, Mongols would have mutton fat and why not use that for oil! The caravan leader assured us that he had fat in plenty and in ten minutes a great pot of it was warming over the fire.

We poured it into the motor and proceeded merrily on our way. But there was one serious obstacle to our enjoyment of that ride. We had had very little food for some time and were very hungry. When the engine began to warm, a most tantalizing odor of roast lamb arose from the car! Shortly, I even imagined that I could smell mint sauce.

Once again we were without cup grease for the cars and Mrs. Andrews sacrificed all the cold cream and vaseline which she had prepared for a summer in the field. Mongol cheese, too, was substituted with good results.

The caravan trail between Kalgan, Urga, and Kiachta on the Siberian frontier is one of the oldest trade routes in the world and is the only one in Mon-

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golia on which automobiles have been operated to any extent. The Chinese government maintains a passenger service as a branch of the Peking-Suiyuan Railway over this route and it has proved successful after some initial difficulties. A private Chinese company also ran cars in 1918–19 between Kalgan and Urga, but they had a great deal of misfortune. During one year nineteen cars were smashed and lay in masses of twisted metal beside the road. The difficulty was due largely to the native chauffeurs. Although these men can drive a car they have no mechanical training and danger signals from the motor are entirely disregarded. Moreover, all Chinese dearly love "show" and the chauffeurs delight in driving at tremendous speed over roads where they should exercise the greatest care. The deep cart ruts are a continual menace, for between them the road is often smooth and fine. But a stone or a tuft of grass may send one of the front wheels into a rut and capsize the car. The Chinese company has lost count of the passengers killed or injured!

We must be prepared to meet all sorts and conditions of ground in Mongolia. In some places the grass-covered plains are as hard and smooth as a floor; in others the surface is a chaotic mass of ruts and holes, and on the Gobi Desert soft sand alternates with solid beach like stretches of fine gravel.

Our motor equipment will consist of six five-passenger cars and two one-ton trucks. The latter will act as movable bases and the expedition can thus work in widely separated regions. Supplies of gasoline will be carried in the trucks, or will be sent by camel caravan to various wells in the region which will be the center of operation.

The use of motor trucks will be a new departure and one which should have important economic results. Transportation is the greatest of all commercial factors in the Orient and upon it largely depends the development of any country. In Mongolia the problem can be easily solved. At present it rests upon camel caravans, ox- and pony carts, and upon automobiles for passengers. Camel traffic begins in September and is virtually ended by the first of June. Then its place on the trail is taken by ox- and pony carts. Camels make the journey from Kalgan to Urga in from thirty to fifty days but the carts require twice as long. They travel slowly at best, and the animals must be given time to graze and rest. Of course they cannot cross the desert when the grass is dry, so that transportation is divided by the seasons—camels in winter and carts in summer. Each camel carries from 450 to 500 pounds, and the charges vary from five to fifteen cents (silver) per *cattie* (one and one third pounds). Thus by the time goods reach Urga their value has increased vastly.

As against thirty to ninety days for the journey between Kalgan and Urga, motor trucks could easily make the trip in five days. Trucks have never yet been used on the Mongolian plateau and our expedition will have the honor of "breaking the trail." The machines which we have selected are the regular one-ton trucks made by the Fulton Motor Company, of Farmingdale, Long Island. This car has a speed of forty miles an hour, is light, and so strongly made that it is especially fitted for the rough work on the plateau.

The motor transportation of the expedition will be in charge of Mr. Bayard Colgate, of Orange, New Jersey. Mr. Colgate, who has a thorough knowledge of automobiles and their construction, will be responsible for the care and operation of the cars and will have a number of native mechanics under his direction.

Unfortunately, the Mongolian plateau is the only region which the expedition will investigate where motor transportation is possible under present conditions.

The greatest need of China is good roads and every year sees an advance in this direction; with increasing development of its natural resources road building will inevitably advance and a great field will open for motor transportation.

THE GREAT FRIAR OF THE PARAMO

BY

HERBERT J. SPINDEN*

The *Espeletia* takes its name from one of the Spanish viceroys of New Granada, named Espelata. It is the characteristic plant of the paramo or land above timber line in the eastern Andes of Colombia and Venezuela and grows to a height of six or seven feet. The few leaves which come out fresh each year are felted deep against the cold with a cottony growth that almost conceals the underlying green. The name Frailejon—the great friar—comes from the general similarity of these plants, when seen at a distance, to a human figure in white cowl and black cloak

I am the stalwart Frailejon,
  The guardian of the wind-swept pass.
Upon bold peaks and ridges lone
  I piously hold watch and mass.

*Associate Curator of Mexican and Central American Archæology, American Museum

My gown is black of withered leaves
  That hang about my body cold;
My felted cotton cowl receives
  In spring a garlanding of gold.

Where winds the one trail to the gap
  Up from the peopled gorge below,
To drop again to Comfort's lap,
  A cross is set that men may know.

For muleteers there a mass I hold
  Where sodden mosses mat the ground.
And ice-carved cliffs guard off the cold·
  For me, I take my place as found.

Across the faithless paramo,
  Where dwell the gods of ancient days,
Up to the glacier's edge I go
  To make my prayer and tell my praise.

Let Chen, the Fog God, belch his hate
  From caves below the riven peak.
With lifted heart I mock his state
  And for the true Church loud I speak.

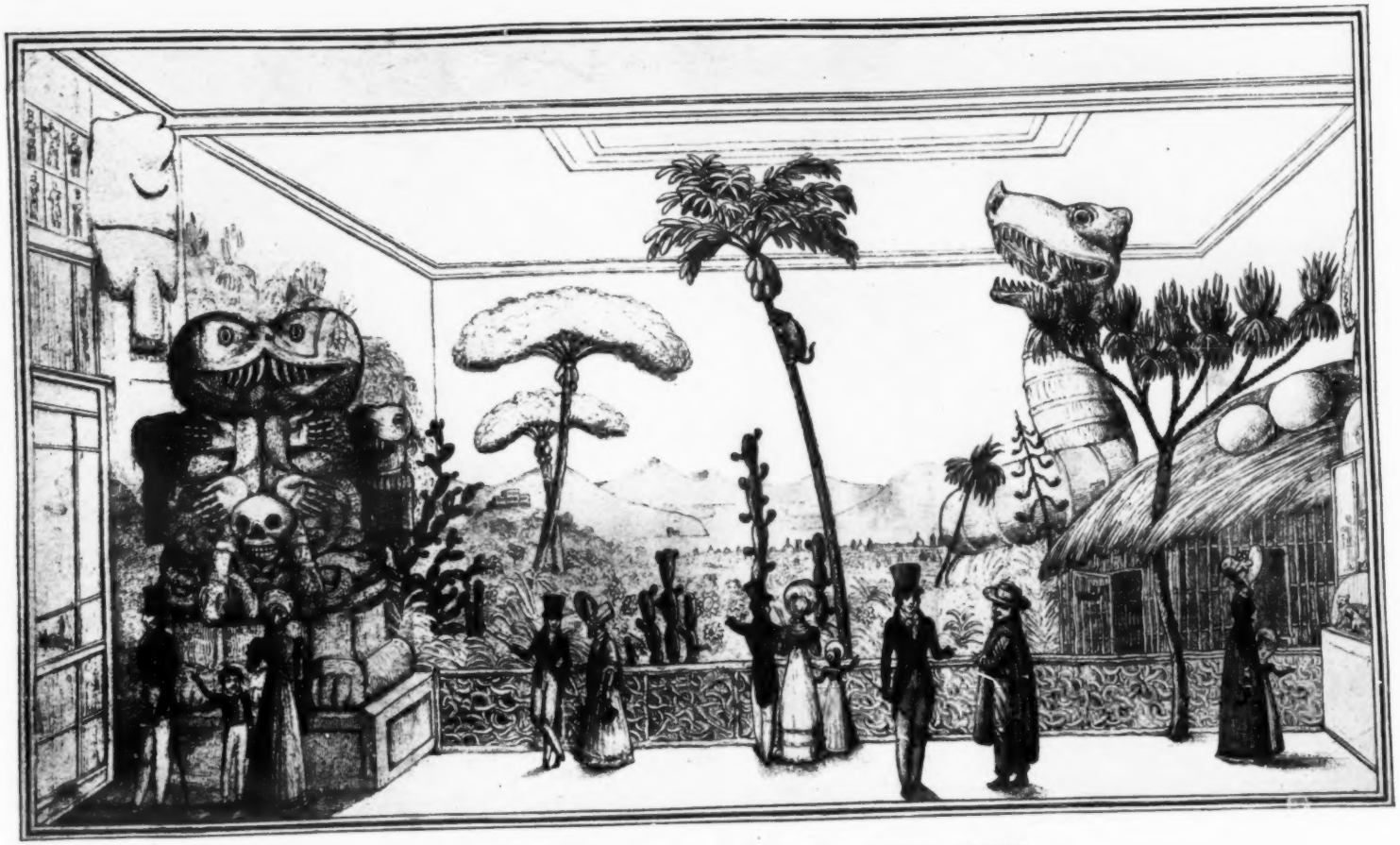
My brothers of the easy life,
  Who fatten in the vale below—
They know not Hunger, Frost, and Strife,
  That walk upon the paramo.

I ask no tithe to purchase wine,
  Nor do I plot for worldly power,
Only I ask the sun to shine
  Upon me for one little hour.

Must I be left the last of those
  That scorn delights and joys resign,
While all my brothers seek repose,
  Or jockey for a place in line?

I am the aged Frailejon
  That stands and faces wind and snow.
My pains the sins of all atone
  Who cross the trackless paramo.

My rusty rags of withered leaves
  A gaunt and shivering form enfold,
Save when my felted cowl receives
  In spring its broideries of gold.



VIEW OF THE EXHIBITION OF ANCIENT AND MODERN MEXICO

Bullock's Piccadilly Museum

GLIMPSES OF EARLY MUSEUMS

BY

FREDERIC A. LUCAS

SOMETHING more than two thousand years ago King Solomon wrote, "Is there anything whereof it may be said, See this is new! It hath been already of old time which was before us."

And some of our younger museum men, installing their striking habitat groups, do not realize that these were foreshadowed a century or more ago nor give the earlier men credit for what they did in the face of many obstacles. What would the present generation accomplish if it had to work in rooms that relied upon fireplaces for heat and candles for light?

So a few words about Bullock's museums that flourished in London from 1795 to 1824 may serve to show how many things were thought of and how much accomplished more than a hundred years ago.

I am indebted to Major W. H. Mullens for the loan of the original engravings from which the illustrations were made and have drawn my information from his account of Bullock's Museum published in Volume XVII of the *Museums Journal*.

"In 1801 Bullock had housed his museum at 24, Lord Street, Liverpool, and in the *Companion* issued in that year he described himself as 'William Bullock, Silver Smith, Jeweller, Toyman, and Statue Figure Manufacturer.' In 1804 or 5 Bullock removed with his rapidly increasing collection from Lord Street to 'premises at the corner of Church Street and Whitechapel [Liverpool] that had been just erected on the site of the old poorhouse, where he had fine apartments fitted up for the museum.' (G. H. Morton.)

"In 1809 Bullock finally removed his museum from Liverpool to London; this date can be definitely fixed from the fact that he published two issues of the seventh edition of the *Companion* in that year. The first describes the museum as being at 'The House of William Bullock, Jeweller and Silversmith to his Royal Highness the Duke of Gloucester, Church Street, Liverpool,' while the second informs us that it was 'now open at 22, Piccadilly, London.' This, however, was but a temporary resting-place, and in the twelfth edition, 1812, it is described as removed to the Egyptian Temple, Piccadilly—known afterward as the Egyptian Hall—which had been 'just erected for its reception.'

"In December, 1822, Bullock, accompanied by his son, sailed from Portsmouth, via Jamaica, to Mexico, remaining in that country some six months, and on his return landing at Portsmouth November 8, 1823.

"In Mexico Bullock was well received by the authorities, and with their assistance he took over possession of the abandoned silver mine of Milan, or Del Bada, near Themascaltepec, and with the aid and sanction of the Mexican Government, he collected many valuable curiosities both ancient and modern, including 'Original Specimens of Ancient Sculpture and Paintings; of Casts of the Enormous and monstrous Idols of the supreme Temple; of the grand Altar or Sacrificial Stone, on which thousands of victims were annually immolated; of a Cast of the famous Kallender Stone (commonly known as Montezuma's watch); of a model of the immense Pyramid of the Sun; of the original map of the ancient City, made by order of Montezuma for Cortez; of remarkable Manuscripts and Picture writings; and of Antiquities in Arts, Manufactures, etc., etc., of this Aboriginal People.'

"With these materials and with specimens of the industry and art of the country, of its mineral resources and vegetable products, and of its natural history, comprising numerous specimens of birds collected by himself, he opened in May, 1824, an Exhibition at the Egyptian Hall entitled 'Ancient and Modern Mexico.'"

Ancient and Modern Mexico is very interesting, for its modeled foreground

BULLOCK'S LONDON MUSEUM
The Group of African Mammals

and painted background, so arranged as to be viewed from a distance, foreshadow the cyclorama so popular in modern times. This exhibition, the outcome of a journey to Mexico, was installed at Egyptian Hall in 1824, or five years after Bullock had disposed of his "London Museum."

One feature of Ancient Mexico, the gigantic Serpent Column that dominates the landscape, is something of a puzzle: As we know today, the Serpent Columns were the door jambs of the Temple of the Jaguars and supported the lintel on their upraised tails—why is this one reversed? Bullock visited Mexico in 1823 and made molds of the Calendar Stone and the Earth Goddess. Why did he figure the Serpent upside down? It is quite possible—even probable—that he was unable to visit Chichen Itza, knew the columns by hearsay only, and constructed them in what seemed to him the correct attitude.

But that Bullock exhibited actual casts of objects like the Earth Goddess and Calendar Stone that were not shown in the United States until sixty years later, speaks volumes for his energy.

The Group of African Mammals occupying the center of the hall is worthy of note as a bold attempt at a "habitat group." Even today it is a courageous curator well provided with funds that would attempt to show the great mammals of Africa; but here is an exhibit, made by a private individual a century ago, years before Livingstone had even touched the edge of Darkest Africa, that included the largest known mammals.

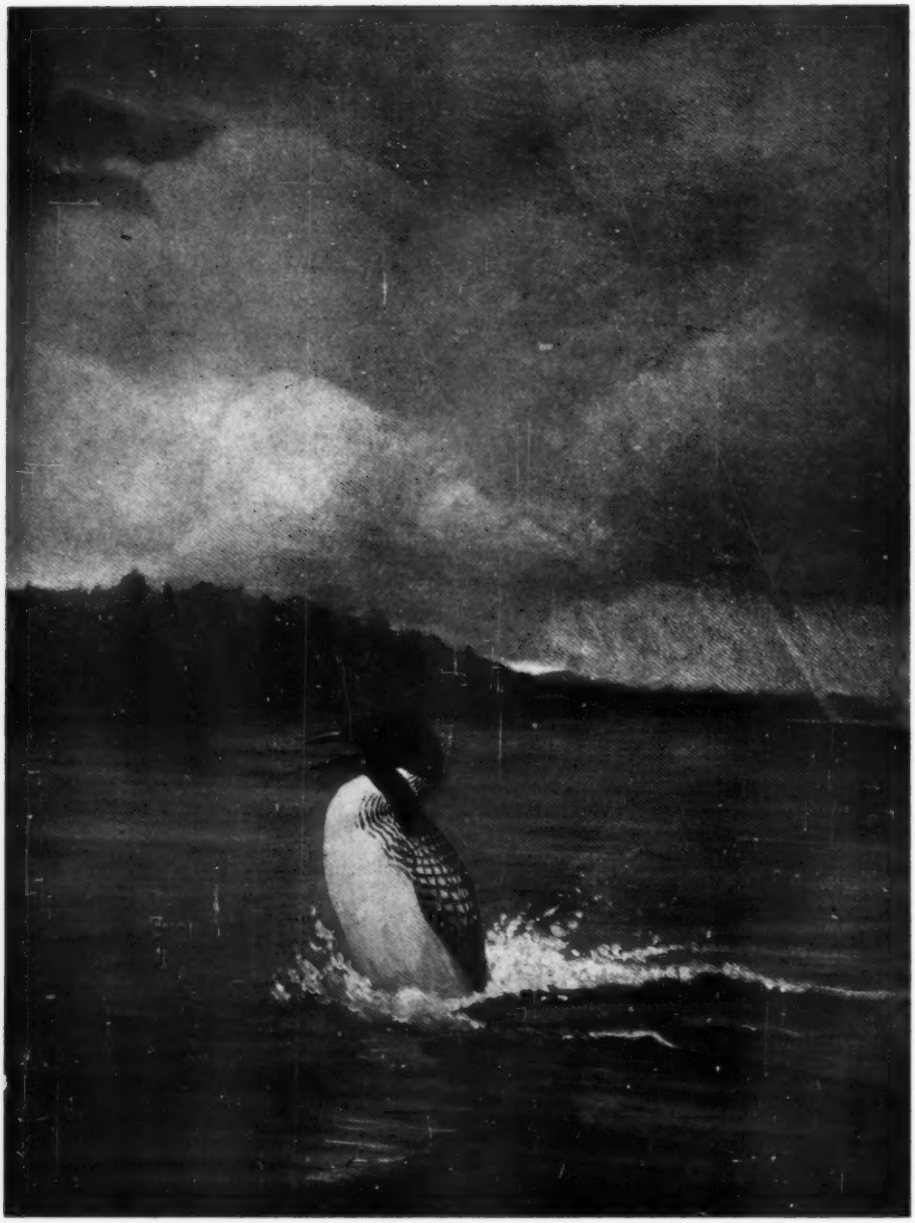
More than this, some of the groups shown in Bullock's Museum seem to have been provided with painted backgrounds and artificial foliage! As stated in the introduction to the *Companion to Bullock's Museum*, published in 1813:

"Various animals, as the lofty Giraffe, the Lion, the Elephant, the Rhinocerous, etc., are exhibited as ranging in their native wilds and forests; whilst exact models, both in figure and colour, of the rarest and most luxuriant plants from every clime give all the appearance of reality; the whole being assisted with a panoramic effect of distance and appropriate scenery affording a beautiful illustration of the luxuriance of a torrid clime."

This seems very much like a description of some recent habitat group, in fact, one can say little more of our Florida and Orizaba groups in the American Museum. And when we consider the handicap of building and especially of lighting under which these early museum men labored, we can but admire their courage and skill.

But even earlier than this, that universal genius, Charles Willson Peale, wrote: ". . . it is not only pleasing to see a sketch of a landscape, but by showing the nest, hollow, cave or a particular view of the country from which they [the animals] came, some instances of the habits may be given." And this was written about 1800, while the first bird group was installed in the British Museum in 1877, and the first in the American Museum of Natural History not until ten years later.

So if "old-timers" like Akeley and myself are inclined to smile at some of the "discoveries" now and then brought forward by younger members at meetings of the Association of Museums, it is well to remember that some of our own discoveries were anticipated by museum men of other days, and to recall, for example, that when in 1885 Akeley and Critchley were called upon to mount the famous Jumbo, they used practically the same method that was employed by French taxidermists in mounting the elephant that died at the Jardin du Roi about one hundred years before. No wonder that after due consideration, Solomon again wrote, "There is nothing new under the sun."



LOON ON AN ADIRONDACK LAKE, CALLING AND RUNNING OVER THE WATER IN A COURTSHIP EVOLUTION

Portrait of a least sandpiper.—Ideal treatment of bird drawing for purposes of scientific illustration

COURTENAY BRANDRETH'S BIRD PAINTINGS

BY

FRANK M. CHAPMAN*

THE form of a bird at rest is so definite, its lines so simple and continuous, that one might imagine they could be reproduced by anyone with even slight talent for drawing. Nevertheless, good bird artists are rare. Possibly the very simplicity of the bird's outline makes it a difficult subject, for although each species possesses its own characteristics of form, pose, and expression, which to the bird student are pronounced and obvious, they are not evident to the artist who has not sufficient interest in bird life to study his subject sympathetically. How many otherwise excellent paintings are marred by the introduction of the figures of birds as anatomically incorrect as would be a human figure drawn with arms, let us say, attached to the hips instead of to the shoulders! No artist would attempt to draw a man without having previously studied the original; why, therefore, should he hope for success in bird portraiture when he relies on his imagination rather than on nature for a model?

It requires, however, something more than study from life to produce a wholly adequate bird picture, just as it requires something in addition to good draftsmanship to paint the portrait of a human subject. Where on the one hand there is needed that sympathetic insight into human nature which permits of character interpretation, so on the other there is need for that love of birds which sees not merely a feathered form but a creature marvelously endowed with its own special traits, disposition, and potentialities, which are evident only to one who is familiar with what we call the *habits* of his subject. It is clear, for example, that one should not depict a dove with the expression of a hawk, but only the bird student knows the difference in expression, physiognomy, and attitude between a warbler and a vireo. Without going further it may be said, in a word, that no one has ever reached or ever will reach the first rank of bird artists who is not possessed of that keen interest in birds which marks the born ornithologist.

* Curator of Ornithology, American Museum

BLACK BRANT

The original of this painting was observed at Ossining on the Hudson and the scene in which the bird is placed does not therefore typically represent the haunts of this coast-loving species

This sharp, vibrating response to the sight of a bird or the sound of its voice is a heritage as rare as it is priceless, and when in the fortunate individual possessing it we find also the talents of an artist, we have that exceptional combination of gifts which makes the true bird artist. The world has known but few men and no women of this type, and those who are interested watch eagerly for the exhibition of gifts which mark their possessor as a man of promise in the field of bird art.

During November, 1920, there was held at the Congressional Library in Washington an exhibit of bird paintings at which twenty-four artists were represented. Among the pictures shown were several by Mr. Courtenay Brandreth, of Ossining, New York. Mr. Brandreth's name is new among bird artists, but his pictures aroused such favorable comment that he was subsequently invited to exhibit his work in the American Museum. About twenty-five of his paintings were therefore shown in the forestry hall of the museum in December, 1920, several of which are herewith reproduced.

Black and white reproduction unfortunately gives no indication of Mr. Brandreth's skill as a colorist, but does do justice to his draftsmanship, to the excellence of which the most exacting technical ornithologist would bear witness. Mr. Brandreth's success in portraying form, pose, and expression is due to his natural gifts, to genuine love of birds which sends him to nature for his subjects, and to a course of study under Louis Agassiz Fuertes, master painter of bird portraits.

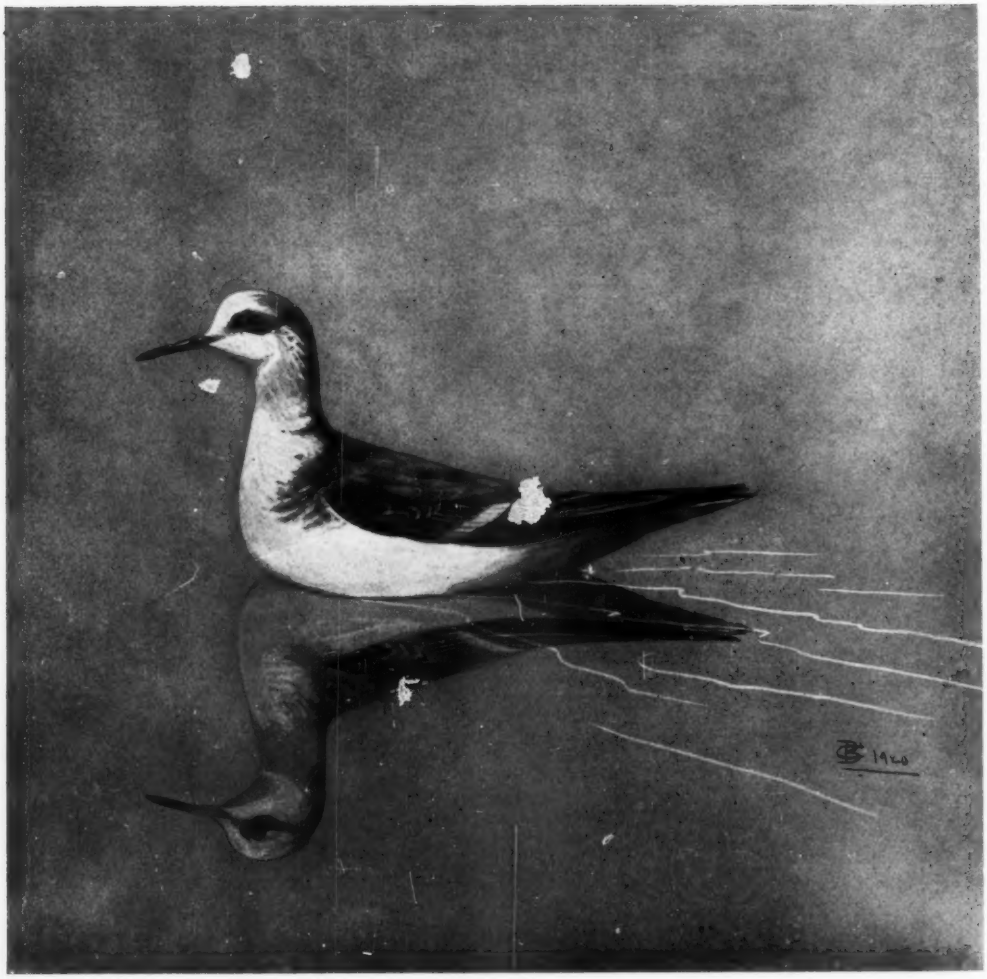
Not only are his birds correct in form, but also in feather. To the landscapist who introduces an alleged eagle or gull into his painting for purely artistic purposes it is quite immaterial whether his figure has five or ten primaries; nevertheless, the same man would not think of giving a human subject an incorrect number of fingers, and to the ornithologist it is quite as important to give a bird its proper number of wing quills.

Mr. Brandreth has certainly not detracted from the beauty of his figures of birds by giving them their due allotment of feathers; he has thereby greatly increased their charm to the bird student who is as much pained by a picture of a five-primaried swallow as he would be by that of a two-fingered man.

But Mr. Brandreth is something more than a gifted and accurate drawer of birds. Among artists of his class his pictures show that he has already attained an unusual measure of success in placing his bird in the landscape, or perhaps I should say in placing landscape about his bird.

The purposes of scientific illustration to aid in the identification of the species drawn are best served by the elimination or suppression of all unnecessary accessories. Given a branch on which to perch, or a stick to stand upon, and all other suggestion of out-of-doors may be omitted. The accompanying evening grosbeak and least sandpiper pictures are good illustrations of this kind of bird drawing. But it is one of the most promising features of Mr. Brandreth's art that he is not content to rest here. In several of the paintings in his exhibition he has aimed to portray not merely the bird on the bough, but the bird in its haunts, a kind of bird painting in which it is evident success can be won only by an artist who is a good landscapist as well as a good bird portrait painter.

The painting of the loon, here inadequately reproduced in black and white, gives some conception of the character of Mr. Brandreth's work in this higher branch of ornithological art. The loon, a male, is shown in one of its courtship evolutions when, calling loudly, it seems to half run, half jump over the water about the female. The bird's excitement at this season is increased by an approaching storm, and its calls echoing over the water voice the spirit of the wilderness. No one who has been thrilled by the loon's weird cries can fail to have the experience recalled by Mr. Brandreth's painting,—an indication, therefore, that



RED PHALAROPE

A swimming member of the order of sandpipers and snipes which sits lightly on the water

TREE SWALLOW PLAYING WITH A FEATHER

Note the detail with which the feathers of the wing are drawn

Female evening grosbeak.—An excellent example of bird portraiture

the artist has at least approached the mark toward which he was aiming.

The brant pictured was captured in the Hudson near Ossining, an unusual locality for this coastwise bird, and the scene in which it is placed is therefore far from typical. The painting, however, is pleasing not only because of the admirable manner in which the bird is drawn, but also because of the skill with which the artist has enveloped the bird in the delicate lavender atmosphere of his painting, without in any way affecting the scientific accuracy with which the colors of the bird's plumage are rendered.

Other subjects give additional proof that if Mr. Brandreth continues to follow the path in which he has made so promising a start, he will win a place among the few men who can claim to be both painters of birds and of nature.

LOCO WEEDS

BY

ARTHUR HOLLICK*

INSTANCES of the poisoning of live stock, especially sheep and cattle, due to their eating plants that possess toxic properties, are frequently reported from widely separated localities throughout the eastern United States; but such instances are isolated and usually only a few or individual animals are victims; and the effects, as a rule, are immediate and acute, with either death or complete recovery following quickly. "Mountain laurel" (*Kalmia latifolia*) and "sheep laurel" or "lambkill" (*Kalmia angustifolia*) appear to be responsible for most of the cases of sheep poisoning, while "poison hemlock" (*Conium maculatum*) and "water hemlock" or "cowbane" (*Cicuta maculata*) are probably responsible for a majority of the cases of cattle poisoning.

In extensive regions west of the Mississippi River, however, the annual loss of horses, cattle, and sheep from "loco poisoning," as it is called, is a serious matter which has to be reckoned with as though it were a disease or pestilence, and unremitting precautionary and preventive measures are necessary in order to minimize its ravages. In some parts of Montana, Colorado, Nebraska, and Kansas, because of the large number of horses that die of loco poisoning, it has been found impossible to allow them to run freely upon the ranges. The losses of cattle have been heavier in Colorado, apparently, than in any other state, while the losses of sheep have been more serious in the states to the north, especially in Montana. The effects are relatively slow in manifesting themselves and the ultimate outcome may be long deferred; but death or more or less permanent physical and nervous derangement is inevitable, according to the extent of the poisoning. The plants that produce these effects are called "loco weeds" and the animals poisoned by eating them are said to be "locoed." This term is of Spanish origin, meaning "crazy," and it is applied by reason of the erratic actions and behavior of the animals during the early and secondary stages of the disease.

Certain initial symptoms appear to indicate a disturbance of the nervous system, resulting in a condition of hallucination. A locoed horse, if led or ridden up to some slight obstacle or inequality in a road, such as a fence rail or a conspicuous rut, will stop short and, if urged forward, will leap as though trying to surmount some obstruction several feet in height, or as if to clear a wide ditch. Objects and inequalities apparently appear to it to be exaggerated in size, although loss of normal muscular control may be the explanation, in part. A badly locoed horse is likely to shy violently, often apparently at some imaginary object, or to move straight ahead until stopped by walking or running into some perfectly obvious bar to further progress. It may also let a person approach without, apparently, its taking any notice, and then will suddenly rear and perhaps fall over backward. Abnormal development of the mane and tail is also a characteristic feature of badly locoed horses.

A steer will start, tremble, and may rear and jump backward if suddenly alarmed and, when badly afflicted, may become frantic and run around or straight ahead until exhausted or stopped by some obstruction. A cow may lose her calf and never be able to find it again, and will not recognize it if brought to her. Loco poisoning also seems to predispose to abortion, and the normal increase in locoed herds is thus seriously reduced.

The symptoms in connection with sheep are not characterized by the

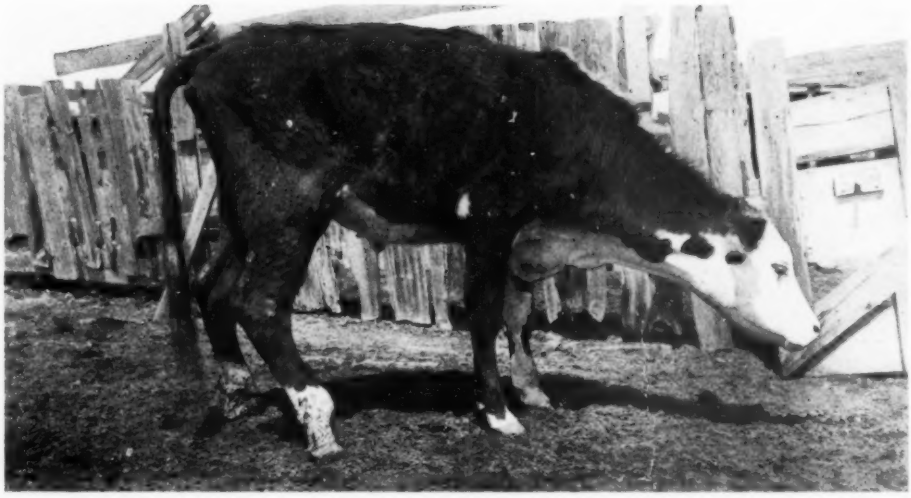
*New York Botanical Garden, Bronx Park

Typical locoed horse.—The abnormal growth of mane and tail is one of the characteristics of loco poisoning in horses. (Photograph through courtesy of the United States Department of Agriculture)

spectacular, violent actions seen in horses and cattle. Lack of muscular control is perfectly evident, but a condition of weakness is the most obvious characteristic. They stumble, fall, and rise again with difficulty. In the final stages all animals are rough-coated, become more or less paralytic, lose flesh, refuse to eat, and ultimately die of starvation.

Practically all grazing animals in the regions where loco weeds grow eat them, at times, to a greater or less extent; but if grass is abundant this is generally preferred, and they do not seem to take naturally to the weeds, as a rule, if grass or other good fodder is readily obtainable. Individual animals, however, sometimes appear to have a predilection for them, and nearly all are liable to contract the loco habit, in which event they will seek the weeds and eat them almost exclusively.

Exactly when it was that loco poisoning first attracted serious attention is somewhat uncertain, so far as any published records are concerned; but it must have been some time prior to 1870, as indicated by an article on the subject by George Vasey, describing instances in California, included in the report of the United States Commissioner of Agriculture for the year 1874. The probability seems to be that it was not until the finer breeds of animals were introduced that loco poisoning produced effects sufficiently extensive to cause apprehension and to lead to careful investigation. Generally speaking, the poorer the breed the less liable to poisoning it appears to be, and native breeds are seldom locoed to the same extent as are those that are imported. The former are more familiar with the forage plants of the region and are more accustomed to travel long distances in search of those that are desirable, whereas imported animals have not learned by experience, and they are also more inclined to eat whatever is most easy of access.



Typical locoed steer.—Note particularly the rough coat characteristic of locoed cattle. (Photograph through courtesy of the United States Department of Agriculture)

Sheep in final stage of diseased condition due to loco weed. (Photograph through courtesy of the United States Department of Agriculture)

Purple loco (*Astragalus mollissimus*). Horses are the principal victims of this plant, which because of its dense covering of hairs is known also as woolly loco, a name applied, however, to several other more or less hairy species. (Photograph by American Museum of specimen in herbarium, New York Botanical Garden)

Blue loco or rattleweed (*Cystium diphysum*). Superficially resembling alfalfa, this plant is particularly dangerous to horses. Cattle and sheep, however, also succumb to its fatal effects. (Photograph by American Museum of specimen in herbarium, New York Botanical Garden)

Probably at least a dozen different species of more or less closely related plants have had loco properties ascribed to them; but similarity in general appearance, and the application of the color character in connection with the popular name,—"white loco," "blue loco," "purple loco," etc.,—have resulted, inevitably, in considerable confusion of identity, especially as striking color variations are common in several of the species. It appears probable that not more than five or six possess toxic properties sufficiently virulent to make them seriously dangerous to live stock, and recent critical investigations by the United States Department of Agriculture have resulted in officially reducing the number of poisonous species of serious importance to three.

The three species now recognized as the typical loco weeds of the West were formerly included, with several hundred others, in the comprehensive genus *Astragalus*, which in recent years, however, has been split up into about seventeen distinct genera. Incidentally, also, it is of interest to note that these and nearly all other plants that are known or suspected to possess true loco properties belong to the Leguminosæ, the family that includes the pea, bean, clover, alfalfa, etc.,—all of them plants of the highest forage value.

Aragallus Lambertii (Pursh) Green (=*Oxytropis Lambertii* Pursh) has the greatest range of the three species mentioned, extending from Mexico to Alaska, east to middle Minnesota and west to middle Arizona and Utah. It includes a dozen or more forms which many botanists are inclined to regard as species; but economically they may all be regarded as belonging to the one species. The flowers are commonly bluish purple, but in some localities a white or albino form is predominant and in others pink is the prevailing color. This species is therefore known either as blue, purple, white, or pink loco, according to the locality in which one or the other color form prevails. It has no true stem and hence is sometimes called "stemless loco"; and the pods, when dry, rattle and make a sound like a rattlesnake, by reason of which the name "rattleweed" is also applied to it. None of these names, however, possesses any value, so far as identifying the plant is concerned, inasmuch as one or another of the names is equally applicable to several other species. The leaflets are relatively long and lanceolate in form. *Aragallus Lambertii* is probably the most destructive of all the loco weeds, not only because of its wider distribution but also because it is equally deadly to horses, cattle, and sheep. It is a source of heavy annual losses in all of these classes of animals.

Astragalus mollissimus Torrey has a range that extends from Mexico to South Dakota, east to middle Kansas and Oklahoma and west to middle Arizona. It rarely grows anywhere in such abundance as the species previously mentioned, but occasionally it occurs in patches that cover several acres. The flowers are usually bright purple in color and the range of color variation is, relatively, inconsiderable, for which reason it is more generally known as "purple loco" than are either of the others. The leaflets are ovate or elliptical and the entire plant, especially the leaves, is densely covered with hairs, from which the popular name "woolly loco" is derived. This name, however, is also applied to several other more or less hairy species that occur in certain areas of the range. *Astragalus mollissimus* is particularly fatal to horses.

Cystium diphysum (A. Gray) Rydberg (=*Astragalus diphysus* A. Gray) is more restricted in its distribution than is either of the others. It ranges from southern Arizona and New Mexico to middle Utah and Colorado and west to southern California. In many localities it grows in great abundance, covering acres almost to the apparent exclusion of all other vegetation. The flowers are

BLUE, PURPLE, WHITE, PINK, OR STEMLESS LOCO

This widely distributed plant (*Aragallus Lambertii*) is alike fatal whatever color form it assumes. Because of its great northward and southward range—from Mexico to Alaska—coupled with the fact that it is equally deadly to horses, cattle, and sheep, it probably deserves the opprobrious distinction of being the most destructive of all the loco weeds. (Photograph by American Museum of specimen in herbarium, New York Botanical Garden)

prevailingly blue in color, hence the commonly applied name "blue loco," and the entire plant presents quite a different appearance from the other two. The leaflets are small, ovate or oblong. In color of flowers and leaves and general style of growth it resembles alfalfa. The seed pods become inflated and bladder-like and, if disturbed when dry, make a noise which has earned for the plant the name "rattleweed" in common with *Aragallus Lambertii* and several other species in more or less closely related genera. *Cystium diphysum* affects mostly horses, but is also fatal to cattle and sheep.

Apparently this species was the first loco weed to attract serious attention, although it may have been confused with *Astragalus Hornii* Gray and *A. lentiginosus* Douglas, both of which, it is said, possess loco properties, and all three of which are native in the southern parts of California.

The exact nature of the constituent that produces loco effects has not, as yet, been satisfactorily determined. The hairs on certain species of loco weeds have been suspected, and it has also been suggested that some obscure fungoid or animal parasite on the plants may be responsible. Neither of these theories, however, has been substantiated. Chemical analysis, also, has failed to isolate any alkaloid of a poisonous nature; but certain mineral elements have been found to be common to nearly all loco plants, and further experimentation with these will, it is believed, yield the information and proof desired.

Photograph by Albert E. Butler

A Colorado meadow, with *Aragallus Lambertii* of evil repute in the foreground

THE GILA MONSTER

The species shown here (*Heloderma suspectum* of Arizona) is distinguished from its less known but larger Mexican relative (*H. horridum*) by the greater number of orange and yellow spots on the head. Both forms may be seen in a series of reptiles on the second floor of the American Museum, including the one which served as the original of this photograph

THE VENOM OF HELODERMA[1]

BY

LEO LOEB*

THE Gila monster is a poisonous reptile which is found in certain parts of the United States and in Mexico. There seems to be little definite information concerning the degree of its poisonous character, and occasionally we may hear reports which are evidently exaggerated. It might, therefore, not be without interest to refer to a few of the observations and experiments which were made by us and our collaborators more than ten years ago under a grant from the Carnegie Institution. Two species of Gila monster are known, the common species, *Heloderma suspectum* which is found in Arizona, and the less familiar Mexican form, *Heloderma horridum*. We studied mainly the former.

Heloderma possesses two poison glands of large size which are situated on the outer side of the anterior half of the lower jaw, immediately under the skin. These are a transformed sublabial gland, in contradistinction to the poison gland of snakes which is situated higher up and which corresponds to the parotid gland of mammals.

Each poison gland of the Gila monster consists of three or four lobes, and each lobe ends in a canal which opens on the outer side of the jaw close to the base of the tooth in a groove in which the venom may collect. While in snakes a muscle coat surrounds the gland and expresses the venom, in *Heloderma* the mechanism is somewhat different; here the contraction of the muscle makes tense a fibrous fascia which in turn presses out the fluid from the sacs of the gland. When the animal bites, the secretion gushes into this groove. Consequently the venom is ejected in the neighborhood of several wounds made by the teeth, the grooves present on the outer side of the teeth carrying the venom into the wound. There is, however, no means by which the *Heloderma* can inject venom directly into an enemy as does the *Crotalus*. In order to collect the venom we caused the animal to bite upon a piece of soft rubber, and with a capillary pipette we drew off the secretion from the lower side of the rubber. An animal in good condition will usually chew the rubber for several minutes and each time the jaw closes there is a gush of venom into the groove.

The poison gland resembles glands which prepare digestive juices such as we find in the intestines and stomach of man. In the secreting cells there appear very minute granules in both the ordinary digestive glands of the intestines and in the poison gland. These granules are the carriers of the active digestive substance as well as of the poison. There is known a toxic substance (pilocarpine) which stimulates the production of digestive ferments; we found that this substance stimulates equally well the production of the *Heloderma* venom.

The real function of the poison gland in snakes has not been definitely determined. Some investigators have maintained that it merely eliminates from the blood of the snake the venom which had been formed elsewhere by different cells; others believed that the poison gland itself produces the venom. In snakes the blood or even some organs are poisonous as well as the poison gland; therefore the exact function of the gland cannot very well be analyzed. In *Heloderma* we found the blood and other organs to be free from venom and, through removal of the poison gland, we could determine quite definitely that it is the function of the poison gland to produce

[1] "The Venom of Heloderma," by Leo Loeb, with the collaboration of Carl L. Alsberg, Elizabeth Cooke, Ellen P. Corson-White, Moyer S. Fleisher, Henry Fox, T. S. Githens, Samuel Leopold, M. K. Meyers, M. E. Rehfuss, D. Rivas, and Lucius Tuttle. Carnegie Institution of Washington, Washington, D. C., 1913.

*Department of Comparative Pathology, Washington University School of Medicine, St. Louis

the venom and not merely to eliminate the preformed product.

In order to procure a large amount of venom for experimental purposes we kept a number of Gila monsters in our laboratory. When fed with chicken eggs, these reptiles lived for a considerable time in captivity and behaved quite normally. We thus had a chance to study the properties of the venom and especially its effects on various kinds of animals. We found that the venom as it comes out of the mouth of the animal contains many bacteria which may be quite virulent for certain animals. It was therefore necessary before injecting it to sterilize the venom. This could readily be done by heating it to 100 centigrade for ten minutes. Thus the virulent bacteria were killed, while the venom was preserved. It resisted heat better than the much more poisonous venom of the cobra snake which it otherwise resembled in many respects. If kept in the liquid state the venom gradually deteriorated; but by drying it its strength could be preserved for a long period of time.

It was also possible to free the venom from bacteria by filtering it through porcelain filters with very fine pores, through which the venom passed readily while the bacteria were held back. Through parchment paper, on the other hand, the venom diffused only very slowly.

We tested the effect of the venom on many kinds of animals by injecting it in measured quantities in various ways. All kinds of warm-blooded animals were found to be susceptible to the venom. The lethal dose for a guinea pig was, on the average, $\frac{5}{100}$ of a cubic centimeter of fresh venom or 5 milligrams of the dried material. On the whole, there was not much difference in the sensitiveness of different species of warm-blooded animals, but white rats seemed to be slightly less susceptible. Cold-blooded vertebrates are much less sensitive to the venom than mammals and birds; and especially the toad can stand a great amount, about thirty times as much as the guinea pig, if figured out for equal weights of both species. The venom is not toxic for invertebrate animals.

Wherein does the toxic action of the venom consist? It acts mainly on that part of the brain which regulates respiration, as Van Denburgh and Wight had already observed. When a warm-blooded animal receives a lethal dose of *Heloderma* venom, the first conspicuous effect is a disturbance of respiration. The breathing becomes quickened and the respirations are forced. After a time the respiratory rate diminishes and the respirations grow shallow, until after a period of respiratory spasm they cease altogether.

The venom produces, as we could show, some changes in the structure of the nerve cells. In only a few of the other organs does it produce changes, which usually are very slight.

After a person has been bitten by a *Heloderma*, there may be some swelling near the seat of injury; but it is doubtful whether this effect is due to the action of the venom as such. It is more probable that it is caused by an admixture of another secretion or perhaps it is due to bacterial action.

In general, as to its action on man, a bite of *Heloderma* may cause very marked local changes which, however, in most cases are of a temporary character. It is said that in some instances persons have died as a result of the bite. However that may be, we have not been able to find an authentic case where death was due to the action of the *Heloderma* venom. Knowing the lethal dose for animals, we can figure out that it would be necessary for the Gila monster to introduce at least one half of a cubic centimeter of venom into the wound in the process of biting, in order to kill an adult, but probably a much greater amount would be needed. It seems hardly possible for an animal to succeed

in injecting so large a quantity of venom into the wound.

One of the most interesting observations which have been made in the study of poisonous animals is the fact that the animals are generally resistant to their own venom. This holds good in the case of snakes, and the same we found to be true in the case of *Heloderma*. If we inject, for instance, into a Gila monster as much venom as is sufficient to kill in a short time forty-five guinea pigs, no effect whatever is noticed. On the other hand, *Heloderma* is susceptible to the toxic action of snake venom and snakes are susceptible to the toxic action of *Heloderma* venom. We carried out a series of experiments in which we tried to determine to what mechanism may be attributed this immunity of the Gila monster to its own venom. It seems possible that it is due to the fact that in *Heloderma* the liver and probably also the kidneys have the power to hold back greater quantities of venom than the same organs can in other animals, and these organs thus prevent the venom from reaching the sensitive parts of the brain in a concentration which might be injurious.

It is possible to immunize artificially other kinds of animals, for instance, rabbits, against the venom of *Heloderma*, by injecting them at regular intervals with gradually increasing doses of the venom; thus the injected animals acquire a resistance against the venom. Two of our rabbits withstood the injection of about eight times the dose lethal for ordinary rabbits.

While these rabbits were thus to some extent protected against the toxic action of the venom, they did not yield in their blood an antitoxin which was able to protect another individual not immunized previously against the toxic action of the venom; but inasmuch as we have seen that the venom of *Heloderma* is usually not lethal for human beings, the production of such an antitoxin is not of particular practical importance.

We found, however, that an antitoxin which is active against cobra venom and which has been produced by the French pathologist, Calmette, has a slight antitoxic effect even if mixed with *Heloderma* venom; but this effect is much less than that exerted against cobra venom. As to the chemical character of the *Heloderma* venom Dr. Carl S. Alsberg, who analyzed our material, found that it was not of a protein nature but much simpler in structure, and that it resembled in this respect some snake venoms which had been previously studied.

As we stated above, the action of *Heloderma* venom resembles very much that of the cobra snake; both act mainly on the respiratory center of the brain, both have a slight effect on the blood corpuscles under certain conditions, both are devoid or almost devoid of such marked local destructive actions as are found at the seat of the bite of a poisonous viper or in case the viper poison is injected under the skin of animals. The toxic action of *Heloderma*, however, is much weaker than that of the cobra; and there can be no doubt that both venoms are chemically different.

We see, therefore, that with different mechanisms of secretion, with differently situated poison glands, with different kinds of venom, somewhat similar biological and pathological effects are obtained in two species as distinct from each other as the *Heloderma* and the cobra.

Lower jaw of the Gila monster

ROCK CRYSTAL BALL, TEN CENTIMETERS IN DIAMETER, MOUNTED ON A BRONZE ELEPHANT OF HINDU WORKMANSHIP

Presented to the American Museum by Messrs. Sidney and Victor Bevin

ROCK CRYSTAL BALLS

BY

HERBERT P. WHITLOCK *

AMONG the semiprecious stones there is none, with the exception of jade, which has been so extensively used as a material for carved objects as rock crystal. From Italy and France have come the graceful vases, chalices, bowls, and drinking vessels of classic beauty, of fine and rich ornamentation; from Russia art objects of more severe and geometric treatment, as well as exquisite statuettes and figurines in this limpid medium; and from the Orient the odd-shaped vases and snuff bottles characteristic of Chinese art.

Among all of these, however, there are probably no series of objects fashioned of rock crystal which are more striking than the spheres made by the lapidary artists of Japan. The best of these are cut from flawless quartz crystals, clear and absolutely colorless, and are usually mounted on bronze wrought into decorative forms, such as dragons, storks, tortoises, and grotesque human figures. The clear, polished ball, contrasting with its dark bronze mounting, is preëminently an artistic object, lending itself with especial facility to the Japanese taste, which sets aside one beautiful thing as sufficient to contemplate and admire in an entire room. Groups of these balls delicately balanced in their mountings have been frequently employed in that land of earthquakes to give warning of shocks, the slight preliminary tremors shaking them from their balanced poises.

Rock crystal spheres have, moreover, been since very ancient times the especial stock in trade of the occult foreteller of events. Gazing into the still depths of these bits of earth's clearest substance, these seers of the future, so they tell us, can conjure up pictures impossible of production from commonplace glass. It is this alleged occult property which has raised the rock crystal sphere from a place of preëminent beauty to one of even higher romance and of unreality and woven around it an intricate web of legendary mysticism.

Dr. Dee, a crystal gazer of the seventeenth century, has handed down in his diary a very elaborate and complete description of the methods employed by occultists of that period, which are practically the same as those in use today. The crystal ball is supported upon a background of neutral tone, preferably black, in a room hung with similar draperies and lit only with candles or lamps which concentrate what little light there is present on the crystal. The operator fixes his gaze upon the brilliant spot of light reflected from the polished surface of the crystal until consciousness of his surroundings is replaced by subconscious "vision." It is significant that, in all descriptions of these "visions," what we may call the critical period is marked by the fading away of the image of the ball itself from conscious sight and its replacement by a thin cloud or mist upon which the prophetic "images" appear.

In a certain sense no less marvelous than the alleged occult powers of the crystal ball are the simple means employed by the Japanese artisans in producing them. This art, which, it is said, has been handed down from father to son for generations, consists of manual dexterity carried to a superlative degree. Armed with only two primitive tools, the lapidary shapes from an angular quartz crystal a sphere of perfect roundness and high polish. The quartz crystal is first roughly shaped to the form of a ball by chipping and abrading it with a piece of steel about twelve inches long and one half inch wide, which has a concave cutting edge somewhat like a carpenter's gouge. When by means of this treatment the mass has been made

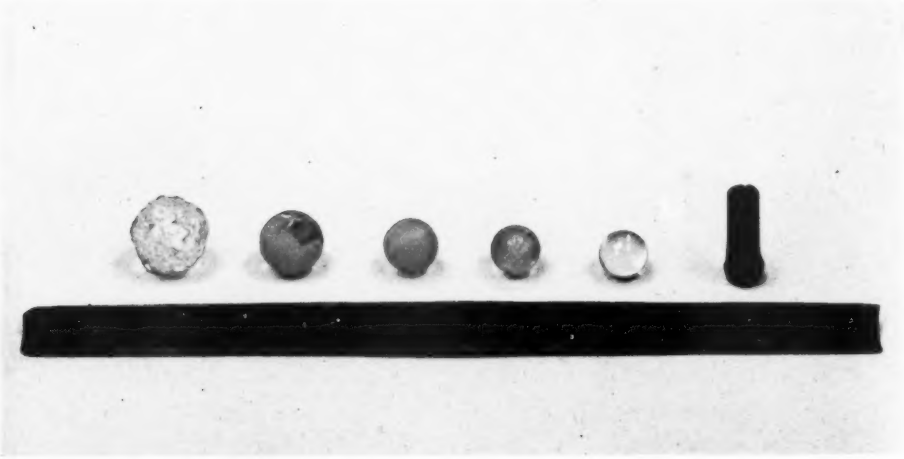
*Curator of Mineralogy, American Museum of Natural History

round and approximately smooth, a joint of bamboo is used to complete the polishing, quartz dust, which lodges in the pores of the bamboo and, finally, rouge, furnishing the abrasives.

This all sounds extremely simple and no doubt is, to one who is trained to do it, but let the reader undertake it himself if he doubts the wonderful manual skill of these Orientals. Of course, in the lapidary shops of Europe and America where the grinding and polishing of crystal balls are undertaken, the lathe and the casting of just the right curvature for a ball of required diameter render the task infinitely more simple; but even with these aids the production of a rock crystal ball of a diameter of, say, three inches is a matter of weeks.

Inasmuch as the labor expended on a crystal ball of even modest size renders it a very costly object, the question which naturally presents itself is how can a purchaser be sure he is buying quartz and not glass? There are two very good ways of distinguishing quartz from its much more plebeian imitator. In the first place, almost every piece of glass large enough for a ball of even small size is reasonably sure to contain one or more round bubbles. Although extremely minute, these may be detected with a good "loop" or hand lens. And inasmuch as quartz never contains round cavities, the presence of these latter will at once stamp the ball in which they are found as spurious.

There is, moreover, a much more exact test, which the writer has found to be applicable to balls from about one and one half inches diameter up. Quartz has the optical property, called double refraction, of exhibiting two images of everything which is viewed through it in a certain direction. It therefore becomes a very easy matter to apply the test by drawing a cross of fine lines on a piece of paper and then resting the ball on this cross and shifting it until a double image of the lines appears to the eye through the ball. It is impossible for a glass ball to produce this effect. So we come at the end to an actual vision which any one can see by gazing into a rock crystal ball.



Primitive tools used by the Japanese lapidaries when making a crystal ball, which is shown in five successive stages of completion. The specimens pictured are from the Egleston Museum, Columbia University

NOTES

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ON December 14 President Henry Fairfield Osborn, of the American Museum, attended a dinner in celebration of the organization of the Cleveland Museum of Natural History and delivered an address on "The City and the Museum." Mr. Paul Marshall Rea, president of the American Association of Museums, was inaugurated as director of the new institution.

On January 14 Director Rea and not a few of the trustees of the Cleveland Museum visited the American Museum and were entertained at luncheon by President Osborn. In acknowledging the courtesies shown them, which included an explanation in detail of the educational work of the museum, Mr. Harold T. Clark, secretary of the board of trustees of the Cleveland Museum, paid this handsome compliment: "It is our hope that in working toward the goal of our ambition for Cleveland we shall always follow the same broad, unselfish policy of helping other institutions that has been so characteristic of the American Museum of Natural History."

PRESIDENT HENRY FAIRFIELD OSBORN, of the American Museum, received notice in January of his election to honorary membership in the Société Belge de Géologie, de Paléontologie et d'Hydrologie, a society founded at Brussels on the seventeenth of February, 1887.

The Society has an appropriate motto, *Mente et Malleo* (with the mind and with the hammer), and numbers among its members Dr. Louis Dollo, Dr. A. Rutot, and other leading palæontologists and geologists of Belgium.

DR. FREDERIC A. LUCAS, director of the American Museum, was elected a Foreign Member of the Zoological Society of London, at their January meeting. This honor is restricted to twenty-five residents of foreign countries and carries with it the privilege of receiving the *Proceedings* of the Society. Dr. Lucas has been a Corresponding Member of the Society since 1911.

DR. HENRY E. CRAMPTON, curator of invertebrate zoölogy in the American Museum, was elected vice president of the American Society of Naturalists at their annual meeting in Chicago in December.

AT the last meeting of the American Association for the Advancement of Science, Mr. Roy W. Miner, associate curator of lower invertebrates in the American Museum, was elected a fellow.

ON January 25, 1921, Dr. Robert Cushman Murphy, associate curator of marine birds in the American Museum, was elected a Life Fellow of the American Geographical Society.

MR. ROY CHAPMAN ANDREWS, associate curator of mammals of the eastern hemisphere in the American Museum and leader of the Museum's Third Asiatic Expedition, expects to sail from San Francisco on March 19, headed for Peking. The scientific staff of the expedition during the first and second years includes, in addition to Mr. Andrews: Messrs. Walter Granger, palæontologist, Charles P. Berkey, geologist; James P. Chapin, ornithologist; George Olsen, assistant in palæontology; Clifford Pope, assistant in zoölogy, and Bayard Colgate, motor transportation. In contrast to the slow and laborious travel by means of the old-time caravan, the expedition will traverse the Mongolian plains with up-to-date motor trucks. The reader is referred to Mr. Andrews' article on pages 69–70 of this issue.

MR. H. E. ANTHONY, associate curator of mammals of the western hemisphere in the American Museum, and Mr. George K. Cherrie, representing the department of ornithology, recently returned to the Museum after a very successful expedition to Ecuador. It is unusual on such a trip to secure mammals exceeding in number a few hundred, but the mammal specimens brought back by the present expedition reached the substantial total of 1560, of which 940 were collected by the expedition. The birds secured numbered about 2200 specimens. The working up of this material should reveal not a few forms new to science. Among the mammals taken are many species hitherto very poorly represented, while the large series collected of the common species will give a much-needed insight into the degree of importance of individual variation.

The base of operations for field work was at an early stage established at Portovelo, the mining camp of the South American Development Company, where the expedition was given every facility and assistance. From this base were made trips lasting from one month to six weeks. An account of the Jivaro Indians, with whom the expedition came in contact, will be given by Mr. Anthony in a subsequent number of NATURAL HISTORY. Specimens of the handicraft and war trophies of these Indians are familiar to those who have visited the third floor of the Museum.

While at Quito, Mr. Anthony called upon Mr. Ludovic Söderstrom, whose name stands out as a landmark in the study of the natural history of Ecuador. For fifty years Mr. Söderstrom has resided in the South American republic, regarding the fauna of which he has accumulated a vast store of valuable data. Mr. Söderstrom generously presented to the American Museum a number of rare and very choice mammals.

The American Museum is cordially appreciative also of the valuable assistance given the expedition by Señor Dr. Don Rafael E. Elizalde, Ecuadorian Minister to the United States, whose interest and help went far toward making the trip a success; by the officers of the South American Development Company, including its president, Mr. William Adams Kissam, its vice president, Mr. J. W. Mercer, its resident manager, Mr. A. M. Tweedy, and its superintendent, Mr. L. O. Kellogg, who gave the expedition housing facilities and assisted in the securing of pack animals, and in many other ways manifested their interest in the undertaking; and by Mr. E. Hope Norton, president of the Guayaquil & Quito Railway Company, and Mr. Paget, superintendent of terminals at Guayaquil, who by their courtesy and aid smoothed the path of travel for the members of the expedition.

THROUGH the instrumentality of its president, Henry Fairfield Osborn, and the good offices also of the Abbé Henri Breuil, of the Institut de Paléontologie Humaine in Paris, the American Museum recently obtained a fine series of stone implements from northwest Africa. This

makes the second collection from Africa acquired during 1920, the first one—a gift from Mr. August Heckscher—being of Egyptian origin. Still other collections of fairly recent acquisition from the late "Dark Continent" hail from Somaliland, the Congo, and Rhodesia, with minor additions also from Cape Colony.

The material in the new collection comprises about 1300 pieces, including implements of flaked and chipped flint, of ground and polished stone, of bone, and also some beads made from stone and from thick egg shells. Geographically, the collection is derived from two principal localities; namely, the vicinity of Tebessa in the Government of Algeria and the region of the Sahara Desert close to the Moroccan border. In all, seventeen or more specific sites are indicated. Chronologically, all the local culture stages, ranging from the Chellean through Acheulean, Mousterian, Capsian (equivalent in time to the Upper Palæolithic of western Europe), and Neolithic, are represented.

While the Museum is not prepared at this time to give a full account of the specimens typical of each culture level, it may be stated at once that the deliberate classification made by Breuil yields some surprises. For example, the Chellean and Acheulean traits do not seem to be distinguished very sharply with respect to the *coup de poing*. What is equivalent to the *Levallois* flake of France is, however, as we should expect, confined to the Acheulean. It is the Mousterian series which is the most startling. Here, in addition to the typical so-called "point," there is a large representation of stemmed points! These are crude and irregular in outline, but otherwise conform to the Mousterian-Aurignacian practice in being retouched on the convex side only. The strange thing is that they disappear with the Mousterian to reappear again, in perfected form, in the Neolithic. A similarly startling fact is the presence in the upper Mousterian of double-pointed blades, chipped on both sides after Solutrean and Neolithic fashion. These also disappear with the rise of the Capsian. The Capsian series itself represents but a crude approach to the varied specializations of the Aurignacian, Solutrean, etc., of western Europe. Toward the end, the double-pointed blade, chipped on both sides, turns up again, this time to be regarded as a forerunner of the Neolithic. The Neolithic series, finally, includes broken pottery, beads of stone and egg shell, some polished celts, and quite a number of chipped arrow points. These last fall into four distinct groups as follows: stemmed, stemless with round base, stemless with straight base, and stemless with a notched base.

Altogether the grouping of the material is not entirely convincing, but as it has been done by one of Europe's most brilliant investigators of the Palæolithic, it must stand for the present. Perhaps the significance of these discoveries in Africa is that we must ultimately give up the idea that the French Palæolithic industrial development is standard for the world.

Dr. Charles-Edward A. Winslow, curator of public health in the American Museum and professor of public health in Yale University School of Medicine, is at present abroad in connection with his responsibilities as general medical director of the League of Red Cross Societies with headquarters at Geneva, having succeeded in this office Dr. Richard P. Strong. Dr. Winslow is impressed with the sound lines on which the League is operating and predicts that it will accomplish a great work. "One turns," says he, "from the organization of a child welfare clinic in Slovakia to a malarial campaign in Spain, a nursing school in Serbia, and a social hygiene conference in Copenhagen, with an inspiring sense of the unity and importance of the modern public health campaign."

While in London, Dr. Winslow took occasion to visit the different museums dealing with public health. He was particularly interested to note that in the great Natural History Museum in South Kensington the central hall on the ground floor was devoted largely to public health. An impressive set of exhibits dealing with insects and diseases there found place. "It is certainly encouraging," Dr. Winslow comments, "to find that in England, as in America, the public health aspects of natural history are recognized as deserving a leading place."

During the great war the American Museum, interested in furthering the cause in which the nation was engaged, prepared a food exhibit. In the form of wax models of different edibles, accompanied by explanations of their value in calories and their food properties, this exhibit served as a trustworthy guide to the community at a time when a judicious use of food was being emphasized as one of the factors necessary to the winning of the war. This exhibit, of service in times of peace as well as of strife, has deservedly survived the emergency that called it into existence. It is now being rearranged to meet the altered conditions. A more or less kindred reminder of war time Dr. Winslow found at the Museum of the Royal Medical College. Here he saw what he describes as "a most wonderful collection of original material dealing with military hygiene, which could not be equaled anywhere else in the world."

Dr. Winslow contemplates a visit also to the Swiss and German museums.

The *American Museum Novitates* is a new publication issued, as occasion requires, for the embodiment of preliminary announcements, descriptions of new forms, and similar matters. The articles are numbered serially but paged in-

dependently. An index will be provided for each three hundred (approximately) pages.

The first two numbers, which appeared on January 31, are devoted respectively to "The Evolution, Phylogeny, and Classification of the Proboscidea," by Henry Fairfield Osborn, and "Descriptions of Apparently New Birds from Bolivia, Brazil, and Venezuela," by Frank M. Chapman.

SINCE the first of the year three letters have been received from Mr. Rollo H. Beck, the American Museum's field representative of the Whitney Expedition in the western South Pacific. The first contains news from Tahiti, where Mr. Beck and his associate, Mr. Quayle, encountered great difficulty during their arduous collecting work, owing to the constant rains and the swollen state of the mountain streams. Among the birds obtained was an interesting species of black rail.

In January Messrs. Beck and Quayle visited Christmas Island, through the courtesy of its owner, Pére Rougier, and also one or more islands of the Marquesas group. At these islands and in the surrounding waters they obtained many species of sea birds, including petrels, gulls, terns, boobies, frigate birds, and tropic birds, as well as doves and other land birds. Noteworthy among the specimens are examples of the rare petrel, *Bulweria bulweri*.

Upon Christmas Island the collectors had the novel experience, as shown in the accompanying illustrations, of visiting by automobile the breeding grounds of birds. Several cases of specimens are now *en route* from the field and their arrival is awaited with deep interest, for no adequate series of specimens, accompanied by exact data, have previously reached the museum from these parts of the world.

THE redwoods (*Sequoia sempervirens*), which share with the Big Trees of the Sierras (*Sequoia gigantea*) the distinction of being the oldest of living things, are threatened with destruction and only prompt action can save them. Along the State Highway in Humboldt County, California, tie camps are being erected with a view to start lumbering as soon as the season permits. To rescue from impending annihilation some at least of these magnificent trees a bill has been introduced in the California State Legislature asking an appropriation of $300,000. The bill vests authority and power in the State Board of Forestry to make purchases out of the appropriation stipulated, of redwood timber lands in Humboldt County, adjacent to the State Highway, to manage and control these lands and, whenever in the judgment of the board it is necessary, to exercise the right of eminent domain in acquiring such lands by condemnation proceedings.

President Henry Fairfield Osborn, of the American Museum, ever vigilant in protecting the natural wonders of our land, sent under date of February 23 to Governor William D. Stephens, of California, the following appeal:

"I write as president of the American Museum of Natural History and as president of the Zoological Society of the City of New York—institutions with combined memberships from all parts of the United States of eight thousand public-spirited citizens, also with combined popular attendance of more than five million people annually—to urge strongly your support of the bill now before the State Legislature of

California providing for an appropriation of $300,000 to purchase redwood groves through Humboldt County.

"I have followed the great movement in New York State which led to the establishment of the superb Palisade and Highland, and Adirondack parks, which are now enjoyed by all the people of the state and especially by those of limited means who cannot afford to travel abroad or to distant countries. It is in the democratic interests of these people of limited means but of firm patriotism that the reserves in the state of California should be made. As you know, I have traversed this country personally. I know almost every foot of it. I think there is no doubt that future generations will call this generation blessed if we save these majestic forests before it is too late and will cheerfully pay the small annual tax. The mind and spirit and soul of man are far more important than his body, yet how readily we tax people for the care of their bodies—for water supply, for sewerage, for roads—and how loath we are to tax them for the enjoyment and advancement of the beauties of nature!

"It is one of the glories of the state of California that so large a percentage of tax funds is devoted to educational purposes. I regard the saving of the redwoods by a small addition to the educational tax as of the greatest value to all the people."

It is to be hoped that by the enactment of the proposed bill and through the activities of the Save the Redwoods League this impressive tree may be permitted to continue to justify its scientific name *sempervirens*, "ever-living," instead of succumbing, after having survived the vicissitudes of the centuries, to the destructiveness of man.

ON DECEMBER 27 last the University of Pennsylvania entertained as guests the American Anthropological Association and the American Folklore Society when these two organizations held their joint meeting in Philadelphia. For the coming year Dr. William C. Farabee, of the University Museum, was elected president, and Dr. John R. Swanton, of the Bureau of American Ethnology, editor and treasurer, to succeed Dr. P. E. Goddard, curator of ethnology in the American Museum, who has edited the publication for the last six years. A number of interesting papers were read, including one by Dr. Robert H. Lowie, associate curator of ethnology in the American Museum, on "The Cultural Connection of Californian and Plateau Shoshonean Tribes," and one by Dr. P. E. Goddard entitled "Notes on the Wailaki of California."

THE government of Chile has under construction at Santiago a large agricultural college equipped with a model farm, vineyards, stables, and other necessary facilities for the teaching and investigation of agricultural subjects. Mr. Vincente Valdivia, director of the department of œnology in the college, recently visited the United States to study the grape industry of California.

AN APPEAL for the preservation and, in some cases, utilization for camping sites of the Indian rock shelters (*asiniwikams*) in Palisades Interstate Park is made by Mr. Meade C. Dobson in the *Conservationist*. These are the only monuments of the aborigines throughout this region. They consist of natural lean-tos or projecting ledges used by the Indian hunters when on the trail. Quantities of arrow points, spear heads, and other relics have been found on their floors at various times, among others by Mr. Max Schrabisch, who explored them extensively in connection with the archæological survey of the state of New Jersey undertaken some years ago by the American Museum. Mr. Dobson's recommendation that park trails be made to pass close to these shelters and that they be converted into comfortable overnight rest places by the use of chestnut slabs and concrete floors, is a picturesque idea but some at least should be kept intact.

THERE is probably no more striking instance of the evil results of man's interference with nature than that shown by the ravages of the gypsy moth (*Porthetria dispar*). This insect was accidentally turned loose in the United States and sums running into the millions have been expended in the effort to exterminate, or at least to limit the range of, the pest. The recent discovery that it had entered New Jersey, a state previously free from its devastations, was, therefore, viewed with alarm. Happily, intelligent efforts are being applied to its control. Mr. H. B. Weiss, chief of the Bureau of Statistics and Inspection, New Jersey State Department of Agriculture, who in the issue of NATURAL HISTORY for September-October, 1920, gave a statement of the problem with which the New Jersey authorities were confronted, records, in the paragraphs that follow, the progress that has been made in combating the evil:

"Due to the prompt action of the New Jersey Legislature in appropriating $112,000 on November 8, for immediate use in fighting this insect, it was possible by the last week of November to place a force of fifty men in the field. This force was increased as rapidly as possible until now (February 1, 1921) there are almost 100 men engaged in the work.

"The infested area at present covers approximately 150 square miles, reaching New Brunswick on the east, Clover Hill on the west, Pluckemin on the north, and Kingston on the south. In this area, the territory in the vicinity of

Duke's Park, Manville, Millstone, Blackwell's Mills, and Bound Brook, which comprises about 50 square miles, is generally infested, while the remainder of the area appears to be only mildly infested. Light infestations have been found also in both ridges of the Watchung Mountains north of Bound Brook.

"At the present time the work consists of locating and killing egg clusters (by painting them with creosote). Of all located egg clusters, two thirds have been creosoted, and the scouting of the entire territory is about one third completed.

"The spraying, which will take place in the spring when the eggs are hatching, will be confined to places in the area where enough eggs were found to warrant the application of the spray. Arsenate of lead will be used. Contracts have been made for the purchase of nine high-power, solid-stream, automobile sprayers, each capable of maintaining a pressure of 225 pounds at the nozzles.

"Two hundred and seventy-three shipments of nursery stock made by the James B. Duke estate to various parts of New Jersey, have been traced and infestations found at eight places; namely, Glen Rock, Wyckoff, Paterson, Madison, Elizabeth, Scotch Plains, South Orange, and Deal Beach. All egg masses found at such places are being creosoted. In the course of the work a rather severe infestation was found in three apple orchards near Mendham, New Jersey, this infestation apparently having no connection with the Somerville colony and its origin being obscure. With the coöperation of the owners, several hundred of these trees are being cut and burned together with brush, etc., in the immediate vicinity.

"All of the extermination work is being conducted jointly by the New Jersey Department of Agriculture and the United States Bureau of Entomology, and the experience of the federal men, gained by long association in fighting the 'moth' in New England, is reflected in the satisfactory progress made in New Jersey during the past several months."

It is the ravages of insects like the gypsy moth that are doubtless responsible for the belief, not infrequently held, that a substantial part of the insect world is inimical to man. Nothing however, could be farther from the truth. As pointed out in connection with the exhibit of insects on the third floor of the American Museum the damage done is almost entirely due to less than 1 per cent. of the species. It is only fair to remember that while the havoc wrought by some insects is extensive, pollination of crops like clover would be impossible without insect visitations, while many of our most beautiful flowers and delicious fruits largely owe their existence to the pollination of their blossoms by the same agencies. Finally, it is upon parasitic insects that man must rely in large measure for the control of insect pests. In waging war upon the gypsy moth the Government has, among other insects, a valuable ally in the beetle *Calosoma sycophanta*.

MR. WILLIAM BEEBE, director of the Tropical Research Station of the Zoölogical Society in British Guiana, returned on April 5 from Georgetown on the S.S. "Guiana" of the Furness Line. The vessel took fire while approaching the harbor of St. Kitts, and Director Beebe stood by Captain Carmichael in the difficult work of extinguishing the fire. Fortunately his valuable collections of notes, photographs, and drawings were saved without serious damage; the loss of this fourth season's work would have been irreparable. An article will soon appear in NATURAL HISTORY describing some of the general features of the work of this laboratory. The *Bulletin* and *Annual Report* of the Zoölogical Society will also contain a full account. Three important articles are in preparation for the third volume of *Zoologica*, which is now chiefly devoted to the work of the Station. One of the most distinguished visitors to the Station this year was Prof. William Morton Wheeler, research associate in social insects, of the American Museum. The working staff included Mr. Tee Van, first assistant; Miss Isabel Cooper and Miss Mabel Satterlee, artists; and Mr. Inness Hartley, Mr. Alfred Emerson, and Prof. J. F. M. Floyd, of Glasgow University.

THE sinister project of utilizing for irrigation purposes the Falls River Basin in Yellowstone Park, with the contemplated erection and maintenance of a dam not more than three miles below the outlet of Lake Yellowstone, has prompted President Henry Fairfield Osborn, of the American Museum, to direct the following vigorous protest to the Hon. Charles L. McNary, chairman of the committee on Irrigation and Arid Lands, United States Senate:

"As president both of the American Museum and the Zoölogical Society, institutions with a national membership of more than ten thousand public-spirited citizens, I record emphatic protest against the corporate influences threatening to invade and despoil the heart of the Yellowstone National Park. Some years ago the Hetch Hetchy Valley of the Yosemite was invaded on a similar plea of the interests of the people of San Francisco. It has now revealed itself in its true light as a water-power project and the people of San Francisco are forgotten. I have studied all the national parks at first hand since 1878. Their enjoyment by the people of the great arid region of the West is exerting a great educational and uplifting influence incomparably more important to the future of America than the present purely material and economic movement. I hope to appear in person before

the Committee at a later date and I request this hearing."

Senator McNary, who presided February 22 at the hearing on the bill before the Committee on Irrigation, United States Senate, stated that the meeting was only the first part of a general hearing that would be held. He added that he had received a number of telegrams and letters protesting against the adoption of the bill and that he had notified the objectors that opportunity would be given for a full hearing.

SIR LAZARUS FLETCHER, the noted English mineralogist, died at Grange-over-Sands on January 6 last, in his sixty-seventh year. Sir Lazarus was appointed director of the British Museum of Natural History in 1909 and held the position until 1918, when he retired to give place to the present director, Dr. Sidney F. Harmer. A note concerning his retirement appeared in NATURAL HISTORY for March, 1919.

Before Sir Lazarus was twenty, his natural aptitude for science and mathematics had won for him two medals and a science scholarship. His deepening interest in the study of crystals brought him to the attention of Professor Story-Maskelyne, who was the Keeper of the Minerals at the British Museum. Sir Lazarus was appointed an assistant in the Mineral Department in 1878, being then twenty-four years of age, and two years later he succeeded to the Keepership. Despite the many duties and responsibilities of his position, he continued with marked success the work on meteorites of Dr. Walter Flight, whose "Chapter in the History of Meteorites" he edited in 1887. In 1892 he published "The Optical Indicatrix and the Transmission of Light in Crystals."

One of his great talents was the ability to use to the fullest extent the educational power of the museum exhibit. The perfection of the specimens in the galleries he arranged, and their logical disposition, the lucid and clear-cut explanations he supplied, the guide books he composed—planned with especial consideration for the needs of the beginner—have proved invaluable to those in search of information.

NEXT to the conundrum, "Does the flying fish fly?" no question has probably met with so many diverse answers as, "Is the bite of the Gila monster poisonous?" Replies have been made by Gray, Gunther, Cope, Mitchell, Yarrow, and Garman, to say nothing of men less widely known, and while these have agreed that *Heloderma* is a suspicious character, some have said that its bite was deadly and some that it was harmless.

More recently Dr. Leo Loeb investigated the poison of the Gila monster with great care, and he has very kindly prepared for NATURAL HISTORY a summary of the results of his researches, which will be found on pages 92-95. Briefly, these are that the venom of *Heloderma* is much like that of the cobra, and its effects, when injected, much the same as those that follow the bite of that snake. And yet there seems to be no evidence that a man has died from the *bite* of *Heloderma*, although several have died *after* it. For it is on record that one man, bitten by a Gila monster, was subsequently run over by a trolley car, and another died happily from acute alcoholic poisoning. It is quite possible, too, that remedies for *Heloderma* bite in the shape of large quantities of poor whisky may have killed one or two persons, as has happened in cases of snake bite. As for pigeons and kittens, it seems to be necessary to shave off the feathers or hair in order to render the bite fatal; otherwise the venom seems to be wiped off before it can penetrate the wound. That birds and small mammals die from injections of *Heloderma* poison is not at all surprising, but *Heloderma* itself fortunately cannot give a hypodermic injection.

Thus *Heloderma* is one of nature's paradoxes, not to say blunders. In it we have an animal provided with a deadly poison but without the apparatus for using it properly. Not only is *Heloderma* devoid of the hypodermic syringe of the rattlesnake, but the poison glands are in the under side of the mouth and imperfectly connected with the teeth, and as liquids do not flow uphill, in order to bite to advantage the lizard should turn itself upside down. Moreover, being a short-legged, heavy-bodied creature, *Heloderma* is sluggish in its movements and still further handicapped by warning coloration. But it has been under a cloud from its first introduction to so-called civilized man, for as early as the middle of the seventeenth century the Spaniards brought from Mexico accounts of a reptile so venomous that even its breath caused death. As with other suspicious characters, it is safest to leave it alone, for at the best it is a beast of uncertain temper: the first one the writer ever saw was used as a plaything by Professor Ward's five-year-old daughter and never offered to bite; the last one, after being handled for a year by an attendant at the Children's Museum, Brooklyn, inflicted the worst bite on record, catching the attendant in the fleshy base of the thumb when the jaws were vertical and there was a good chance for the venom to run along the teeth. But as Goldsmith might have written, the man recovered from the bite; the *Heloderma* died—though some time later.

F. A. L.

DR. LUIS MARIA TORRES, curator of the departments of archæology and ethnology in the Museo de la Plata, has been elected to the directorship of that museum to succeed Professor Lafone Quevedo, who died on June 18, 1920. Professor Quevedo was a distinguished archæ-

ologist and linguist, well known in the United States and in Europe.

As showing the growing recognition and importance of physical anthropology, we have just received from P. Blakiston's Son and Company of Philadelphia a laboratory manual of anthropometry by Dr. Harris H. Wilder that will be reviewed at length in a subsequent number of NATURAL HISTORY.

Two noted anthropologists, the Abbé Henri Breuil, famous for his investigations in connection with palæolithic cave paintings in France, and Sir James G. Frazer, author of the "Golden Bough," received the degree of doctor of letters (*honoris causa*) from Cambridge University last year.

WE ARE apt to think of the bison as of American origin, but ancestral forms of the bison lived in Europe and Asia long before the animal reached the western hemisphere during the Pleistocene. Indeed in Lithuania the *Bos bison* or *Bison bonasus* has survived to the present time. The superb representations of the bison in the Altamira cave in Spain—to cite only one case—testify to the interest that early European man took in this ungulate.

The American Museum has recently received from the Cambridge Museum of Zoology an incomplete skull of the European bison (*Bison priscus*), commonly known as the wisent, with the horn cores nearly perfect and finely preserved. The specimen, which was found in the older Pleistocene gravels of Great Barrington, near Cambridge, was secured as the result of an exchange arranged by the curator of the Cambridge Museum of Zoology, who at one time studied palæontology under Dr. William K. Gregory, curator of comparative anatomy and associate in palæontology in the American Museum.

From the same source and through the same friendly agency the American Museum has obtained a fine skull and jaws of the urus or extinct wild ox of Europe (*Bos primigenius*). It has been thought that this animal represents, in a general way at least, the primitive stock from which the existing domestic cattle have been derived. This view point is discussed in the course of an article on the urus and the bison which Dr. W. D. Matthew, curator of vertebrate palæontology in the American Museum, will contribute to a later issue of NATURAL HISTORY.

MR. EDWARD JAMES NOLAN, for fifty-eight years recording secretary and librarian of the Philadelphia Academy of Natural Sciences, died on January 9 at the age of seventy-four.

THE New York Zoological Garden announced the birth of a pygmy hippopotamus on January 26. This is the second born in captivity. The first was born in the Garden two years ago but was unable to nurse and lived only a few days; it was presented to the American Museum and may be seen in the hall of mammals. The mother is one of three hippopotami brought from Liberia six years ago.

PROGRESS in making anthropometric measurements of inhabitants of the Hawaiian Islands is reported by Mr. Louis R. Sullivan, assistant curator of physical anthropology in the American Museum. Six thousand six hundred individuals had been examined at the close of February and a good growth series obtained of Chinese, Japanese, Portuguese, American, and part-Hawaiian children. It will be difficult, Mr. Sullivan points out, to secure a growth series of pure-blooded Hawaiian children, for among the younger generation of Hawaiians, individuals without admixture of foreign blood are a rare occurrence.

At a meeting of the trustees of the Bernice P. Bishop Museum, held on December 16, 1920, the following motion was unanimously passed:

"*Voted* to record the appreciation of the trustees of the Bernice P. Bishop Museum of the spirit of coöperation in scientific research so graciously shown by the American Museum of Natural History in the leave of absence on full salary allowed to Mr. Louis R. Sullivan, assistant curator in anthropology, in order that he might join one of the Bayard Dominick Expeditions of Yale University now being conducted by this Museum; and

Voted that the secretary be directed to forward a copy thereof to the president of the American Museum of Natural History."

IT IS with great regret that we learn of the death on January 30 of Mr. C. E. Fagan, secretary of the British Museum (Natural History) The following brief but excellent summary of Mr. Fagan's long and valuable services is taken from *Nature* for January 13:

"Mr. C. E. Fagan is expected to retire from the British Museum (Natural History) in the spring of this year. He entered the service of the Trustees in 1873, and became assistant secretary in 1889. He received the title of secretary in 1919, in recognition of the conspicuous value of his services. It is safe to say that Mr. Fagan has done more than any other living man in developing the importance of the museum as a center of scientific activity. His long experience, his grasp of affairs, and his unfailing capacity for forming a correct judgment have made his coöperation and advice invaluable to the Trustees and to his colleagues. His administrative ability has been of the greatest service to successive directors, whom he has assisted in innumerable ways, while during more than one period of interregnum he has succeeded

in maintaining the efficiency of the museum at a high level. Although not himself an investigator, Mr. Fagan has taken a keen interest in many aspects of natural history and has been quick to appreciate the importance of an opening, whether the chance of securing a valuable collection or the opportunity of encouraging an expedition to some distant country. He has been closely associated with such societies as the British Ornithologists' Union and the Royal Geographical Society, the interests of which are connected with those of the Natural History Museum. Opportunities of making the museum practically useful have a special appeal for him and he has taken great interest in exhibits of economic importance. From the first he has been a strong supporter of the close connection which happily exists between the museum and the Imperial Bureau of Entomology. Mr. Fagan has rendered exceptional services to science by single-minded devotion to his ideal of increasing and developing the scientific importance of the museum. The fact that he is suffering from a severe illness at the time which he had hoped to devote to putting the finishing touches to his long period of successful service will command the ready sympathy of his many friends."

Dr. George F. Herbert Smith (D. Sc. Oxon), late of the department of minerals in the British Museum (Natural History) succeeds Mr. Fagan as assistant secretary.

MR. BASIL H. SOULSBY, M. A., has been appointed librarian of the British Museum (Natural History), in the general library, with supervision over the five departmental libraries, —zoölogy, entomology, geology, minerals, and botany.

THERE has been a growing feeling among the employees of the American Museum that, because of the very evident necessity for specialization in the work of the various departments, a proper perspective and knowledge of the work of the museum as a whole was not possessed by its workers. In answer to many requests to remedy this situation, the administration has inaugurated a series of informal talks for its employees, to be given every other Wednesday from 12:45 to 1:15 o'clock. It is planned to supplement these lectures by visits to the different exhibition halls under discussion until eventually all the departments of the museum have been covered.

The introductory lecture was given on January 19 by Director Lucas, who chose as his subject, "The Purpose and Aim of a Museum." This was followed on February 2 by Dr. Reeds' address on "The Meaning of Geology to a Museum." A week later Dr. Reeds conducted a tour through the hall of geology. "Why Palæontology," was the subject of Dr. Matthews' address at the last meeting in February.

IN LINE with our efforts to save the redwoods it is worthy of note that in far-off New Zealand enlightened protest has been made against the wanton destruction of the native trees. As long ago as 1903 a vigorous and convincing plea for timely protection of the forests of the islands was made in the Second Annual Report of the Department of Tourist and Health Resorts, New Zealand. "Our forests," says the Report, "have been and still are being destroyed in a wholesale, ruthless manner, without a thought being given to the future. In many cases bush lands have been sold for very small sums, and valuable timber has been wasted in a manner which is absolutely a crime against the nation. The timber on areas of utterly worthless land, quite unfit for settlement, has been burnt off, denuding the soil of the only crop it will ever produce."

Both in the conditions encountered and in their solution, which includes the recommendation that "the Government immediately proceed to resume the control of specially interesting and attractive forest lands on the principal routes of travel," the Report shows that the struggle for scenic preservation that has been waged in our own country has had its counterpart in other lands.

THE members of the American Museum have been cordially invited to join the Cascadians during their summer outing on the east side of Mount Adams, Washington, from August 7-21. The club proposes that those taking part in the outing leave Yakima, Washington, by automobile at eight o'clock on the morning of August 7. Camp fire programs will be arranged and games played on the greensward at permanent camps. There will be many easy trips for those who cannot take part in the more strenuous excursions of the seasoned climbers. Communications should be addressed to Mr. J. R. Vincent, Yakima, Washington.

NOT the least interesting thing in the recent report of the Biological Survey is the fact that it shows very clearly the difficulties man has brought upon himself by his intentional or unintentional interference with nature. Also, that an animal may be beneficial at one time or in one locality and harmful at another.

On one page we are told of the plague of rabbits, on another of the bounties on coyotes, nature's most effective check on the rabbits. Ground squirrels and prairie dogs are pests in some places, but we see nothing about encouraging badgers to keep them in check. On one page we are told that meadow larks are seriously destructive of sprouting oats, and two pages farther on that they are among the birds having the best records as destroyers of grasshoppers.

One of the last items in the report is a timely

plea for conservation of marsh areas, whose utility is generally overlooked. In parts of Massachusetts the influence of the conversion of "pond holes" and swamps into cranberry bogs is well marked in the shrinkage of ponds and the consequent decrease of fishes. There is the ever-recurring clash between the "sentimentalist" and the so-called "practical man," and we are by no means sure that the former gets just treatment—why should thousands of people be deprived of the pleasure of seeing birds and mammals amid their natural surroundings because a few people wish to make a few more dollars? For the practical man does not for a moment think of any one besides himself and, while he poses as a public benefactor, he has not the slightest intention of sharing his profits with his neighbor. Not that the sentimentalist can have it all his own way, either—it is doubtful, for example, if beavers can be allowed in many parts of the Adirondacks, but in others they should be a source of revenue. Man is himself partly to blame for this state of things for he has depleted the forest to such an extent that it cannot recuperate fast enough to keep the beaver in provisions.

ALONG with other heads of government departments the Commissioner of Fisheries reports a serious depletion of his technical staff (36 per cent) during the last year.[1]

Notwithstanding this depletion, the biological investigations of the Commission have been notably advanced. The commissioner reports progress in the study of the life histories and migration of the Pacific Coast salmon and of the whitefish and ciscoes of the Great Lakes. Valuable information has been secured also from investigations on the paddlefish and smelts. Diseases of fishes in the St. Lawrence River were investigated and experimental work in fish culture has been carried on. The Commission's steamers, *Albatross* and *Fish Hawk*, which had been loaned to the Navy Department for war service, were returned and again utilized in oceanographic studies and fishery trials. Of the laboratories, the only one actively operated was that at Woods Hole, Massachusetts, which was engaged in investigations on oysters, the reddening of salt fish, gelatin from seaweed, and the habits, food, and parasites of fishes.

THE first text in the English language on anthropometry, the science of human measurements, has just been published by Dr. Ales Hrdlička of the United States National Museum. It is a wholly original work based on the international anthropometric agreements. Dr. Hrdlička covers all aspects of the science: the use of the instruments, technique of measurements on the living, on skeletal remains, and on the cadaver. He also includes some physiological observations. In the issue of NATURAL HISTORY for November-December, 1920, mention was made (p. 595) of the recently installed exhibit in the southwest pavilion on the second floor of the American Museum, illustrating the definite points of measurement agreed upon by anthropologists to insure uniformity of methods and thereby make possible a comparison of the results of one investigator with those obtained by another. This exhibit will prove particularly valuable to those interested in physical anthropology.

THE *History and Bibliography of Anatomic Illustration in Its Relation to Anatomic Science and the Graphic Arts*, by Dr. Ludwig Choulant, first published in 1852, has recently been republished in translation by the late Dr. Mortimer Frank, secretary of the Society of Medical History, Chicago (University of Chicago Press). The work includes an account of pictorial anatomy from the earliest times, chiefly in the form of biographic-literary notes on different anatomists and artists. Three appendixes have been added: one by Dr. Choulant on "Chinese Anatomy"; a second by Dr. Fielding H. Garrison and Dr. Edward C. Streeter on "Sculpture and Painting as Modes of Anatomical Illustration"; and a third by Dr. Garrison on "Anatomical Illustration Since the Time of Choulant."

INCREASED efficiency in the use of the microscope for biological purposes has been attained with ultra-violet light by means of which photographs are taken showing greater resolution than with ordinary light.[1] As objects which are transparent in ordinary light show definite absorption bands in ultra-violet light, this photographic method is its own staining process. An additional advantage is that the material can be dealt with in the living state. The chief difficulties lie in the technique which requires considerable familiarity with physical methods, and in the expense of the optical apparatus, which must be computed from fused quartz.

[1]Annual Report of the Commissioner of Fisheries to the Secretary of Commerce for the year ended June 30, 1920.

[1]J. E. Barnard. "Microscopy with Ultra-violet Light." *Nature*, Vol. 106, p. 378. Nov. 18, 1920.